United States Department of Agriculture

# Coronado National Forest
# Land and Resource Management Plan

**Cochise, Graham, Pima, Pinal, and Santa Cruz Counties, Arizona, and Hidalgo County, New Mexico**

Forest Service Southwestern Region MB-R3-05-15 April 2018

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**Front cover photos** (clockwise from upper left): Meadow Valley in the Huachuca Ecosystem Management Area; saguaros in the Galiuro Mountains; deer herd; aspen on Mt. Lemmon; Riggs Lake; Dragoon Mountains; Santa Rita Mountains "sky island"; San Rafael grasslands; historic building in Cave Creek Canyon; golden columbine flowers; and camping at Rose Canyon Campground.

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# Land and Resource Management Plan
# Coronado National Forest

## Cochise, Graham, Pima, Pinal, and Santa Cruz Counties, Arizona
## Hidalgo County, New Mexico


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# Forest Plan Organization

The forest plan is organized as follows:

**Chapter 1: Introduction** describes the Coronado National Forest, summary of the analysis of the management situation, the purpose of this plan, its content, and organization. This chapter does not contain any plan decisions.

**Chapter 2: Forestwide Management** contains plan decisions and other content that are applicable throughout the Coronado National Forest.

**Chapter 3: Management Areas** contains plan decisions, suitability of areas, and other content that is applicable to particular management areas. The Coronado National Forest is divided into six management areas, including wilderness areas and land use zones.

**Chapter 4: Geographic Areas** describes management direction that applies to unique geographic areas called ecosystem management areas.

**Chapter 5: Suitability** describes suitable uses of specific resource management practices and special use permits for particular areas of land.

**Chapter 6: Monitoring and Evaluation** contains the monitoring plan decisions and provides a framework for subsequent monitoring and evaluation.

**Glossary:** Provides definitions of select words from this forest plan.

**References:** Literature and documentation referenced in the plan.

**Appendix A: Climate Change Trends and Coronado National Forest Land Management Planning** provides regional and national guidance related to climate change and forest planning, and describes the relationship between both.

**Appendix B: Proposed and Probable Management Practices** are projections of what actions may take place in the future at the project or activity level to achieve the desired conditions.

**Appendix C: Communications Sites** identifies the designated communications sites located on the Coronado National Forest.

**Appendix D: Animal and Plant Species**, with both common and scientific names, mentioned in this plan.

**Appendix E: Other Sources of Information** is provided to aid in implementation of this plan.

# Chapter 1. Introduction

## Purpose of the Land and Resource Management Plan

This land and resource management plan (referred to primarily as the "forest plan") is a guide for management of the Coronado National Forest for approximately the next 15 years.[1] This plan:

- Is strategic in nature. It does not include project and activity decisions. Those decisions are made later, only after more detailed analysis and further public involvement.
- Is adaptive in that new knowledge and information can be analyzed and the forest plan can be amended, if appropriate, at any time.
- Honors the continuing validity of private, statutory, or pre-existing rights.

This forest plan represents a revision of the 1986 Coronado National Forest Land and Resource Management Plan. The revision was conducted under the legal framework of the National Forest Management Act, and the provisions of the 1982 Planning Rule, as allowed by the 2012 Planning Rule language.[2]

## Overview, Roles, and Contributions of the Coronado National Forest[3]

The Coronado National Forest is an administrative component of the National Forest System. It administers approximately 1.78 million acres of National Forest System lands. National forests across the United States were established to provide natural resource-based goods and services to American citizens, and to protect timber and watershed resources. Management of national forests is jointly based on the principles of conservation and multiple use. The Coronado National Forest contributes a wide range of goods and services to its visitors and communities.

The present day Coronado National Forest has its origins in 1902, when the Santa Rita, Santa Catalina, Mount Graham, and Chiricahua Forest Reserves were established to protect timber and watershed resources. Over the years, national forest units were combined, expanded, and reduced to result in the current configuration, which was established in 1953 (figure 1). It is now organized as five ranger districts and the supervisor's office. Each ranger district administers one or more ecosystem management areas (figure 2), with the supervisor's office providing oversight for all administrative functions on the Coronado. The Douglas Ranger District (located in Douglas, Arizona) administers the Chiricahua, Dragoon, and Peloncillo Ecosystem Management Areas. The Nogales Ranger District (located in Nogales, Arizona) administers the Santa Rita and Tumacacori Ecosystem Management Areas. The Safford Ranger District (located in Safford, Arizona) administers the Galiuro, Santa Teresa, Winchester, and Pinaleño Ecosystem Management Areas. The Sierra Vista Ranger District (located in Sierra Vista, Arizona) administers the Huachuca and Whetstone Ecosystem Management Areas. The Santa Catalina Ranger District (located in Tucson, Arizona) administers the Santa Catalina Ecosystem Management Area.

[1] May be revised sooner if needed because of important changed conditions.
[2] Refer to 36 CFR 219.7(b)(3)
[3] Parts of this section are excerpted from The State of the Coronado, Sky Island Alliance in 2008.

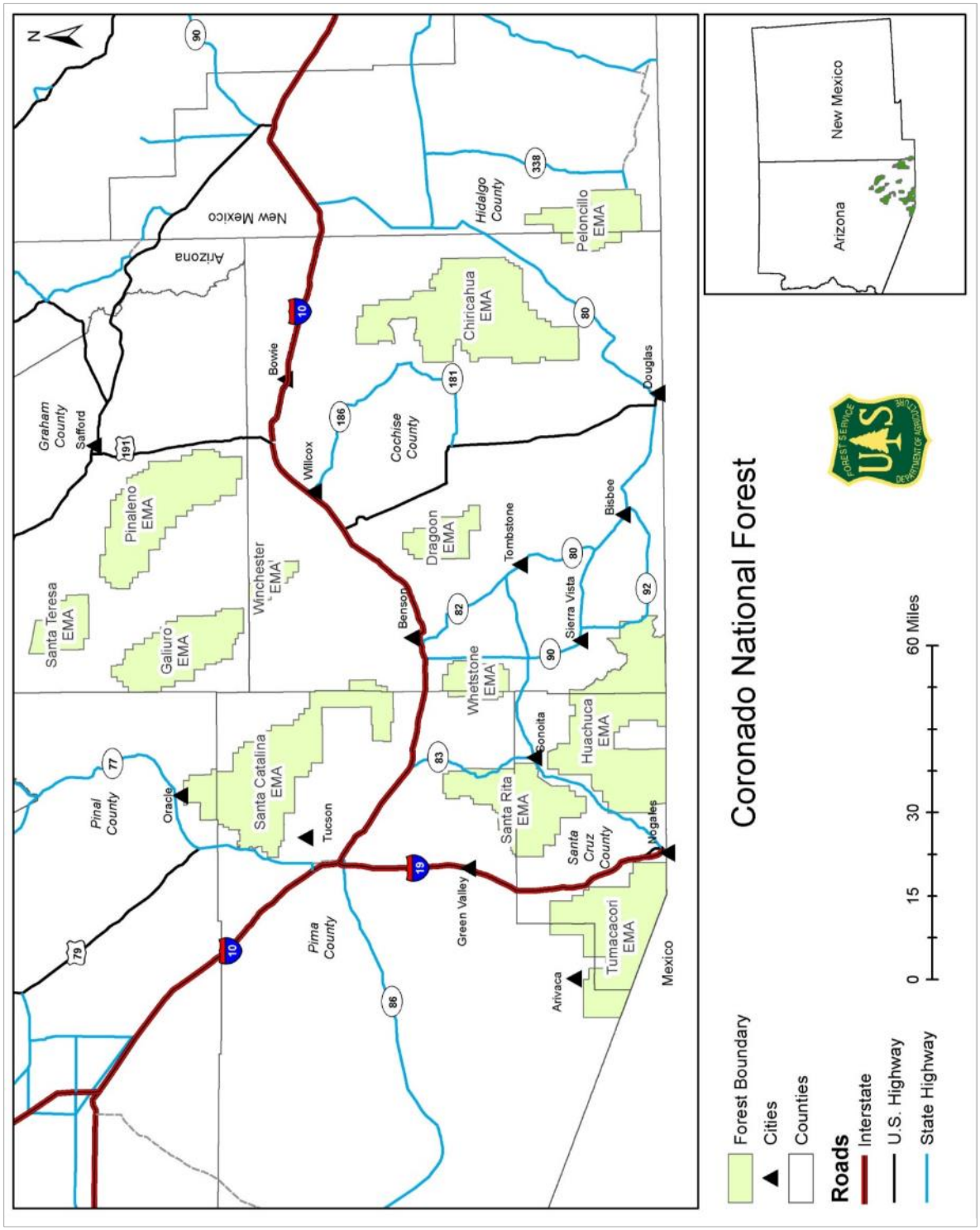


**Figure 1. Location of the Coronado National Forest**

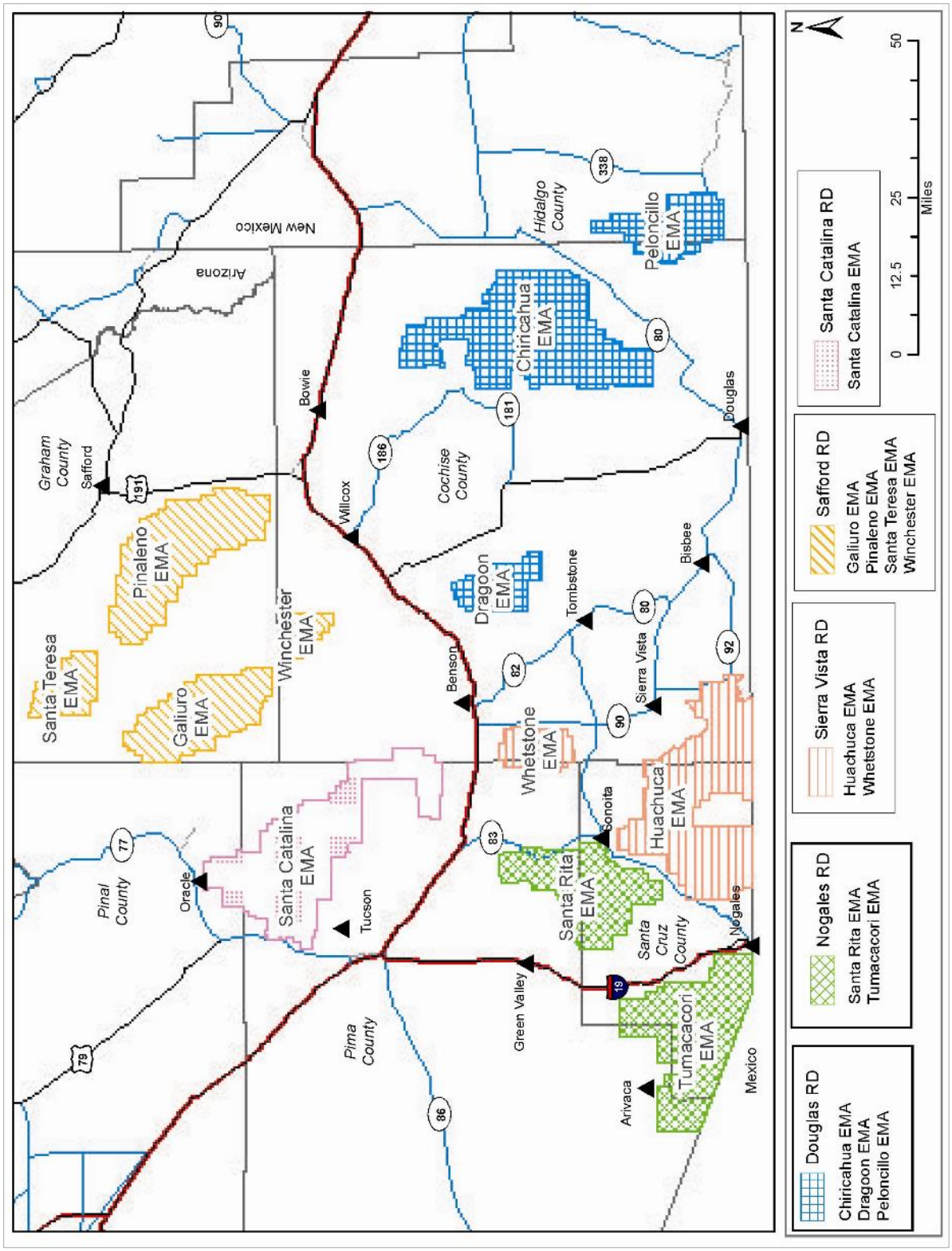


**Figure 2. Location of five ranger districts on the Coronado National Forest and the ecosystem management areas (EMAs) contained within them**

The Coronado Forest Plan covers all National Forest System lands within the boundary of the Coronado National Forest. While management direction is limited to national forest administrative boundaries, broader scales are also considered in the forest plan.

## Communities with Ties to the Coronado

There are 12 federally recognized Native American Tribes with a potential interest in natural, historical, cultural, and other resources of the Coronado National Forest. These Tribes include the Ak-Chin Indian Community, Fort Sill Chiricahua-Warm Springs Apache Tribe, Gila River Indian Community, Hopi Tribe, Mescalero Apache Tribe, Pascua Yaqui Tribe, Salt River Pima-Maricopa Indian Community, San Carlos Apache Tribe, Tohono O'odham Nation, White Mountain Apache Tribe, Yavapai-Apache Nation, and the Pueblo of Zuni.[4]

Counties that surround the Coronado National Forest include Cochise, Graham, Pima, Pinal, and Santa Cruz Counties in the State of Arizona and Hidalgo County in the State of New Mexico. The southernmost portion of the Coronado National Forest shares a contiguous international border with Mexico.

## The Sky Islands

The lands of the Coronado National Forest consist of 16 widely scattered mountain ranges representative of basin and range topography, and are often characterized as "sky islands." These sky islands form distinct land masses located in southeastern Arizona and western New Mexico. They offer an unusual range of vegetation types and climates; the tree-covered mountains rising from grassy savannas and the Sonoran and Chihuahuan Desert lowlands are home to plant and animal communities described as among the most diverse found on Earth. The mountains of this region are part of the "Madrean Archipelago," which describes the chain of sky islands that stretch from the southern latitudes of the Sierra Madre Occidental to the northern latitudes of the Rocky Mountains (DeBano et al. 1995). The Sonoran Desert and Chihuahuan Desert also come together in this region, creating an overlap zone where many plants and animals are at the edge of their ranges (Gelbach 1981).

The regional landscape began to take form between 70 and 40 million years ago during a period of intense folding and faulting. The activity was of volcanic and igneous intrusive origin, and of greatest importance in the placement of major ore bodies. Most of the present ranges were uplifted during the basin and range disturbance between 30 and 25 million years ago. The basin and range development exposed older rocks derived from a diverse geologic past: multiple marine invasions, volcanic explosions and lava flows, and metamorphic core complexes. Each sky island is a remarkable mixture of rock types including granite, rhyolite, dacite, basalts, gneiss, schists, quartzite, limestones, shale, and conglomerates. This great mix of rock types has led to an assortment of soils that support a huge diversity of grasses, shrubs, and trees; talus slopes that support a remarkable diversity of snails; limestone slopes and outcrops that greatly increase the diversity of plants; and vegetation growing in unexpected climatic zones. The erratic ridgelines, subtle tones of blue-gray limestone, speckled granite, and pastel volcanics are a visual reminder of the many forces that shaped the sky islands.

[4]A map of Arizona Tribes is available at: http://edrp.arid.arizona.edu/Tribes.html

## Ecosystems of the Coronado

The 12 ecosystem management areas that make up the Coronado National Forest range in size from approximately 18,937 acres in the Winchester Ecosystem Management Area to 284,619 acres in the Chiricahua Ecosystem Management Area (figure 2). Each ecosystem management area supports a unique combination of vegetation, habitats, and wildlife, thus harboring an amazing amount of biological diversity. Distinct species have evolved within the Coronado's sky islands due to barriers to movement. Mountain ranges harbor numerous endemic and rare species such as Mount Graham red squirrel, Peloncillo talussnail, Huachuca water umbel, and Chiricahua squirrel.

The Pinaleño Ecosystem Management Area supports as many as 18 species of plants and animals found nowhere else in the world. Sheltered canyons in the Huachuca, Chiricahua, Santa Catalina, and Santa Rita Ecosystem Management Areas support a remarkable variety of bird species that attract birdwatchers from around the world.

Because of the north-south axis of the mountain ranges and their great variation in elevation, the Madrean Archipelago spans three major climatic zones (temperate, subtropical, and tropical). Following the recession of glaciers in North America, the climate of southeastern Arizona became warmer and drier, shifting the distribution of vegetation. Conifer forests that were once in the valleys as well as the mountains, disappeared from lower elevations. They hung on only in higher elevations where the air was cooler and precipitation more frequent. Arizona cypress, also common on hillsides and lowlands, retreated to cooler canyon bottoms. Sonoran and Chihuahuan Desert vegetation, able to endure the warmer, drier conditions filled in the valleys and low elevations. Because of warming, plants left from this period are arranged on mountain slopes with species requiring less moisture and able to stand more heat at the lowest elevations, and species requiring the coolest and most moist conditions at mountain summits, sheltered canyon bottoms, or on north-facing slopes.

The vertical stacking of life zones[5] in these steep mountains packs tremendous species diversity into the space of each slope. In a day's walk, one can climb through desert and scrub habitats characteristic of central Mexico, up to spruce-fir forests characteristic of Canada. Madrean encinal savanna and woodland are widespread at middle elevations in this region, forming one of the distinguishing features of the sky islands of the Coronado National Forest. Encinal communities bear strong affinities with flora of the Sierra Madre, and are strikingly different from oak-dominated communities in other parts of the United States. Floral surveys of several U.S. sky island ranges have found species diversity at the community level to be higher in encinal woodlands than in virtually any other resident plant community, with roughly twice the number of species than is typical for temperate plant communities. Oak woodlands also support some 43 percent of the tree species known from the entire bi-national region. The Coronado National Forest manages the highest proportion of Madrean pine-oak woodlands and Madrean encinal woodlands across all major landowners in Arizona.

The sky island region has received national and international recognition for its conservation value. In 1999, World Wildlife Fund recognized the greater Chihuahuan Desert Ecoregion as globally outstanding in its biological distinctiveness and named the ecoregion a top continental-level conservation target. The Coronado National Forest is located in the northwestern part of the Apachean Subregion of the Chihuahuan Desert Ecoregion. In 2001, Conservation International

[5] Environments characterized by particular groupings of plants and animals.

recognized the Madrean pine-oak woodlands and sky islands of Mexico and the United States as conservation hotspots.

### Cultural and Historic Values

The Coronado National Forest retains remnants from its complex historic and cultural legacy. From pictographs, petroglyphs, and pottery shards left by ancient peoples; to remains of old mines and ranches, the lands of the Coronado harbor a wealth of cultural values. Place names across the Coronado are reminders of cultures and people who have lived in the sky island region and shaped the character of the land. Native American Tribal interest in the region remains strong. Despite having been nearly pushed out of the area in the late 19th century, Apache families continue to travel into the mountains of the Coronado National Forest to collect food products, medicinal plants, and to visit sacred sites. Today, many of the mountains managed by the Coronado are regarded as Apache homeland, and as such, are meaningful and sacred.

### Recreational Opportunities

A wide variety of year-round recreational opportunities is available within the Coronado National Forest. Higher elevations are more popular during the summer, offering temperatures 20 or more degrees cooler than the desert. Lower elevation recreation areas are located in scenic canyons and foothills; these are most popular during the fall, winter, and spring. Special places that are popular include Sabino Canyon Recreation Area, Mount Lemmon, and Madera Canyon. Recreation opportunities on the Coronado include over 1,100 miles of trails (including the Arizona Trail, a national scenic trail), three scenic byways, five lakes, rental cabins, a state park,[6] and dozens of developed campgrounds and picnic areas. Recreational opportunities also include skiing, historic interpretation, and private cabins.

### Social and Economic Contributions

The social and economic environment surrounding the Coronado National Forest is as diverse as the natural environment. It includes large urban areas, international border cities, and many rural communities. Goods and services provided by the Coronado National Forest include forage for livestock production, fuelwood, and forest products such as beargrass for baskets, fiddleneck ferns for flower arrangements, and manzanita branches for birdcage perches. The lands within what is now the Coronado National Forest continue to provide sustenance and spiritual values to Native American Tribes. Outfitting and guiding services provide an important link between visitors and the ecological treasures of the Coronado. Many areas of the Coronado are highly mineralized, and the Forest Service has an important role in administering mineral exploration and extraction while minimizing surface resource impacts, consistent with mining regulations and policy. Of primary and increasing importance are the watersheds and the ability to capture the precipitation that recharges aquifers, supplying domestic water sources to the cities and towns surrounding the Coronado National Forest.

## Summary of the Analysis of the Management Situation

The management situation is described in the “Comprehensive Evaluation Report” (USDA FS 2009a) and Supplement (USDA FS 2010). Together these documents meet the content requirements of the “Analysis of the Management Situation,” as required by the procedures of the 1982 Planning Rule, by describing the social, economic, and ecological conditions and trends in

[6] The State of Arizona operates Catalina State Park within the proclaimed boundary of the Coronado National Forest under a special use permit.

and around the Coronado National Forest. The Comprehensive Evaluation Report integrates key findings from the "Ecological Sustainability Report" (2009), the "Social and Economic Sustainability Report" (USDA FS 2009c) and input from the public and Forest Service employees. The Comprehensive Evaluation Report notes where the 1986 forest plan does not provide adequate management guidance for the present and future, and it identifies where the conditions and trends indicate a need for change from the 1986 plan.

The Comprehensive Evaluation Report and Analysis of the Management Situation identified five primary areas where there are priority needs for change in program direction; ecosystem restoration, safety and information, public access and travel patterns, preservation of open space, and collaboration and partnerships. These need for change categories eventually defined five topics for forest plan revision:

- Ecosystem Restoration and Resiliency
- Visitor Experiences
- Access to National Forest System Lands
- Preservation of Open Space
- Communities, Collaboration, and Partnerships

## Ecosystem Restoration and Resiliency

Conditions have changed since the forest plan was issued in 1986, including the recognition that vegetation conditions (structure, composition, and function) are divergent from reference conditions, forest conditions indicate a substantial departure from the natural fire regime, and there are plant and animal species that need further consideration in the planning process. There are also emerging issues not addressed by the 1986 plan (such as nonnative invasive plants and animals and climate change).

The following are needs for change to the 1986 plan. They include the need to:

- Develop desired condition statements and objectives that provide adequate guidance for sustaining and restoring ecosystems.
- Change plan components to reflect new scientific knowledge and updated language.
- Integrate plan components for ecological attributes, where possible, to reflect the interconnectedness between physical and biological resources.
- Change to include objectives and guidelines that reflect systematic observation and analysis of treatment results and adaptation of treatment methods based on those results.
- Reflect knowledge and uncertainties associated with changing climate.
- Develop plan components for reducing the threat of invasive species and for conserving native species.
- Develop plan components for sustaining aquatic habitats that are at risk.
- Develop place-based geographic area plan components where it makes sense to do so.

## Visitor Experiences

The social environment surrounding the Coronado National Forest has changed significantly since 1986. Although the current plan anticipates negative impacts associated with regional population growth and increased urbanization, it does not identify strategies for sustaining the national forest resources and experiences in the face of these changes.

Other unanticipated forces have come to bear in the region, notably illegal activity associated with the international border with Mexico. Undocumented immigrants crossing into the United

States through the Coronado National Forest from Mexico, as well as drug smuggling activity, cause unprecedented resource damage as well as public and employee safety issues.

The topic of off-highway vehicle management is addressed in the current forest plan. However, it is still a prominent issue and updated management direction is needed. The collaborative process for forest plan revision reflects desires for increased enforcement of rules for off-highway vehicle use and concerns about effects on visitors' experiences and natural resources. The Forest Service has identified the significant increase in illegal off-highway vehicle activity as a major component of unmanaged recreational use. A related concern is the slow loss of opportunities for quiet recreation. The Coronado National Forest is currently implementing the Travel Management Rule, which is an opportunity to increase control of motorized vehicle use and decrease user conflicts and resource damage. The forest plan needs to be changed to provide the overall desired conditions for motorized use that the Travel Management Rule will reflect, as well as to address the general suitability of motorized uses in different areas of the Coronado.

The current forest plan is organized around the concept of management areas that are largely based on the capability of an area to produce certain types of vegetation. This was consistent with the resource "output" based plans of the 1980s. As such, it does not address social uses—such as motorized vehicle use and recreation—in much detail. The revised forest plan needs to do a better job of defining social uses, especially those that are being compromised by increasing use and those that are destructive. One way to address this topic is to define land use zones that are based on social uses rather than vegetation production communities. This type of strategy will guide managers in focusing resources to address social problems, as well as to take advantage of opportunities to improve safety and protect resources. Place-based plan components will also help to focus management strategies.

The following are needs for change to the 1986 plan. They include the need to:

- Identify new strategies for sustaining the forest resources and experiences in the face of changes in population, behavior, and increased development.
- Develop place-based geographic area plan components where it makes sense to do so.

## Access to National Forest System Lands

The need for legal rights-of-way to allow public and administrative access to the Coronado National Forest is identified as an issue in the current forest plan. Although progress has been made toward the goal of obtaining rights-of-way, the issue has become more complicated and updated management direction is needed. Currently, less than 100 of the approximately 300 access points to the Coronado National Forest's 1.7 million acres from outside its proclaimed boundaries have permanent legal access.

The rapid growth of Arizona's population has led to a much greater need for public access to National Forest System lands. At the same time, population growth has led to increased development and impacts on interior and adjacent private lands, resulting in more restricted public and administrative access. Many public roads and highways (county, State, and Federal) pass between administrative units (12 units in 6 counties and 2 states), with private or State Trust lands residing between those public roads and highways and Coronado National Forest lands. If access across those private lands is denied, the public and Forest Service are left without legal access.

Public access issues are not easily solved, particularly when dealing with differing opinions from multiple users. A range of concerns has been expressed by the public, including rights-of-way

issues, damage and liability issues for private landowners, the ability to use forest trails, roads, and facilities, and considerations to restrict vehicular access in some areas. Flexibility as well as a comprehensive, coordinated, and collaborative public access effort is central to resolving many of this Coronado's public access needs.

To meet the challenge of providing adequate and appropriate access to the Coronado National Forest in the future, the forest plan needs to be changed to include desired conditions and objectives that emphasize and prioritize public and administrative access needs. These need to be structured around a particular area within or adjacent to the Coronado National Forest. This is different from the current approach, which identifies specific individual access points, roads, or trails. By assessing needs based on areas rather than specific points, roads, or trails, flexibility and opportunities to resolve public access issues are increased. Land use zoning as described in the previous section will also help to focus the efforts for providing adequate and appropriate access to the Coronado National Forest.

The following are needs for change to the 1986 plan. They include the need to:

- Include desired conditions and objectives that emphasize and prioritize public and administrative access needs.
- Identify management approaches that facilitate comprehensive, coordinated, and flexible collaborative solutions for resolving public access needs.

## Preservation of Open Space

Preservation of open space is a particularly important land use issue given both the public's desire to maintain the "rural character" of county lands and the need to accommodate rapidly growing populations and municipalities. This issue has been identified by the Forest Service as one of the four greatest threats to ecological sustainability (USDA FS 2005a); however, it is not addressed in the current forest plan. If ecosystem sustainability is to be realized, management direction for the Coronado National Forest will need to consider land uses beyond the national forest boundary (USDA NRCS 2008). The concept of preserving open space is widely recognized as a primary tool for sustaining ecosystem components and processes across landscapes.

This theme overlaps with needs for change identified for ecological sustainability in the recognition of ecological services provided by private lands managed as open space, and the need to protect and provide wildlife corridors between the sky islands of the Coronado National Forest. It also reflects the increased difficulty in managing planned and unplanned fires due to increased development along and within the boundary of the Coronado National Forest. In addition, development and subdivision of private land and the resulting loss of open space leaves large tracts of National Forest System lands without legal access and inaccessible to the public.

The forest plan needs to be changed to include desired condition statements that reflect the role of the Coronado National Forest in preserving open space by providing forage for livestock grazing, a land use that is compatible with preserving open space, and reducing fragmentation by consolidating National Forest System lands and private lands with high resource values within its boundaries. Desired condition statements could also reflect the role of the Coronado National Forest as a cooperating stakeholder in local government land use planning processes, providing information on how growth decisions will affect public land resources and public access, and including local communities in planning for National Forest System lands to help coordinate local land use with the forest plan. Other possible changes could include guidelines, based on the Scenery Management System, to protect scenic natural landscapes.

The following are needs for change to the 1986 plan. They include the need to:

- Develop desired condition statements that reflect the role of the Coronado National Forest in preserving open space.
- Develop guidelines, based on the Scenery Management System, to protect scenic natural landscapes.
- Develop management approaches for participating in county and community land use planning efforts.

## Communities, Collaboration, and Partnerships

In recent years, the Forest Service has placed increasing priority on the relationships between national forests and surrounding communities, as well as communities of interest. There is a growing realization that the Coronado National Forest will need to work in partnership with other entities to sustain the natural and social environment within its boundaries. For example, the effort to sustain species diversity, as with the effort to sustain ecosystem diversity, will require working across jurisdictional boundaries. All agencies and nongovernmental organizations that manage wildlife, fish, rare plants, and their habitats need to work together as complete partners, rather than relying on an individual group or agency to bear the burdens of management and conservation. The current forest plan does not provide guidance for the type of collaborative conservation efforts that will be needed in the future.

Native American Tribes have expressed desires for more accommodation of traditional uses and cultural uses in decisionmaking and planning. They would like clarification of the role of cultural and other noneconomic values in decisionmaking about such issues as Mount Graham located on the Pinaleño Mountain Range; the incorporation of traditional knowledge in management and planning; attention to site protection and privacy issues in the management of cultural resources; and a desire for cooperative management of resources of mutual interest to the Tribes and Forest Service. The current forest plan addresses cultural resources in one section, separate from the others, and provides no real guidance for incorporating traditional knowledge.

The following are needs for change to the 1986 plan. They include the need to:

- Include desired conditions that reflect, where possible, outcomes that are based on collaborative processes.
- Develop management approaches that emphasize collaboration.
- Reflect an integrated approach to management of traditional uses and cultural resources.

Other needs for change have been and will continue to be identified. New information and changing conditions will necessitate changes in management. As these become ripe for action, iterative and adaptive management may result in changes to the plan. For example, following the large wildfires of 2011, a changed condition assessment was conducted and the information was used in the development of this plan.

## Forest Plan Content

This plan includes “plan decisions” and “other content.” Once approved, any substantive changes to plan decisions will require a plan amendment. A change to other content may be made using an administrative correction process. Administrative corrections are also used to make nonsubstantive changes to plan decisions such as corrections, updates of data and maps, and to fix typographical errors. The public is notified of all plan amendments and administrative corrections.

### Forest Plan Decisions

Forest plan decisions include six main elements: goals (hereafter referred to as desired conditions), objectives, standards, guidelines, the designation of special areas and management areas, the identification of management suitability, and monitoring and evaluation. Throughout the document, plan components (plan decisions) are displayed within gray borders. Texts outside of these areas are not plan decisions; such text is composed of general descriptions, background material, explanations, or descriptions of management approaches.

**Desired conditions** set forth the desired social, economic, and ecological attributes of the Coronado National Forest. They attempt to paint a picture of what we (the public and Forest Service) desire the national forests to look like and the goods and services we desire them to provide. Desired conditions are normally expressed in broad, general terms and are timeless in that there is no specific date by which they are to be completed. Desired conditions may only be achievable over a long timeframe (in some cases, several hundred years). In some cases, a desired condition matches the current condition, and the goal is to maintain it. Desired conditions are aspirations and are not commitments or final decisions to approve projects

To be consistent with the desired conditions of the plan, a project or activity, when assessed at the appropriate spatial scale described in the plan (such as landscape scale), must be designed to meet one or more of the following conditions:

- Maintain or make progress toward one or more of the desired conditions of a plan without adversely affecting progress toward, or maintenance of, other desired conditions; or
- Be neutral with regard to progress toward plan desired conditions; or
- Maintain or make progress toward one or more of the desired conditions over the long term, even if the project or activity would adversely affect progress toward or maintenance of one or more desired conditions in the short term; or
- Maintain or make progress toward one or more of the desired conditions over the long term, even if the project or activity would adversely affect progress toward other desired conditions in a negligible way over the long term.

The project documentation should explain how the project is consistent with desired conditions and describe any short-term or negligible long-term adverse effects the project may have on the maintenance or attainment of any desired condition.

**Objectives** are concise, time-specific statements of measurable planned results that make progress toward or maintain desired conditions. An objective forms the basis for further planning to define the precise steps to be taken and the resources to be used in achieving desired conditions. The objectives represent just some of the expected outcomes or actions required to accomplish movement toward desired conditions. Not every action or objective the Coronado National Forest may initiate is identified in the plan, just the primary ones.

Variation in achieving objectives may occur during the next 15 years because of changes in environmental conditions, available budgets, and other factors. Objectives are strongly influenced by recent trends, past experiences, anticipated staffing levels, and short-term budgets.

A project or activity is consistent with the objectives of the plan if it contributes to or does not prevent the attainment of any applicable objectives. The project documentation should identify any applicable objective(s) to which the project contributes and document that the project does not prevent the attainment of any objectives. If there are no applicable objectives, the project must be consistent with the objectives decisions of the plan, and the project document should state that fact.

**Standards** are constraints upon project and activity decisionmaking. A standard is an absolute requirement to be met in the design of projects and activities. A project or activity is consistent with a standard when its design is in accord with the explicit provisions of the standard; variance from a standard is not allowed except by plan amendment.

**Guidelines** are components with which a project or activity must be consistent, in either of two ways:

- The project or activity is designed exactly in accord with the guideline; or
- A project or activity design varies from the exact words of the guideline, but is as effective in meeting the purpose of the guideline to contribute to the maintenance or attainment of the relevant desired conditions and objectives.

Guidelines must be followed, but they may be modified somewhat for a specific project if the intent of the guideline is followed and the deviation is addressed in a decision document with supporting rationale. When deviation from a guideline does not meet the original intent, however, a plan amendment is required.

**Special areas** are lands that have designations by Congress or another delegated authority. Special areas are designated because of their unique or special characteristics. This plan provides direction for the following special areas: scenic byways, national recreation trails, eligible and suitable wild and scenic rivers, botanical areas, zoological areas, proposed and designated research natural areas, and recommended and designated wilderness.

Where the plan provides plan decisions specific to a special area, a project or activity must be consistent with those area-specific decisions. The project documentation should describe how the project or activity is consistent with the area-specific decisions of the plan.

**Management areas** are spatially defined areas for which a unique set of plan components are defined. The Coronado forest plan proposes three types of management areas: special areas, land use zones, and ecosystem management areas (otherwise known as “geographic areas”). Special areas are established at a national level either through legislation (congressional designation) or at a regional or local level through administrative action (administrative designation). The forest plan may recommend the establishment of new special areas. Land use zones are defined by the types of uses and desired settings that would occur in them under the forest plan. They occur across districts, mountain ranges, and ecosystems but have commonalities that make their overarching land uses similar. Ecosystem management areas are defined geographically to include one or more mountain ranges. These mountain ranges are used to distinguish the ecosystem management area’s unique social and ecological issues with appropriate plan components.

**Suitability** describes the appropriateness of applying certain resource management practices (uses) to a particular area of land. A unit of land may be suitable for a variety of individual or combined uses.

A project with the purpose of timber production may only occur in an area identified as suitable for timber production.[7] The documentation for the project should confirm the project area meets the suitability requirements.

Except for projects with a purpose of timber production, a project or activity can be consistent with plan suitability determinations in either of two ways:

- The project or activity is a use identified in the plan as suitable for the location where the project or activity is to occur; or
- The project or activity is not a use identified in the plan as suitable for the location (the plan is silent on the use or the plan identifies the use as not suitable), but the responsible official determines that the use is appropriate for that location's desired conditions and objectives.

The project documentation should describe that the project or activity is either (1) a use for which the area is specifically identified in the plan as suitable, or (2) not a use for which the area is specifically identified in the plan as suitable, but is nonetheless appropriate for that location.

**Monitoring and Evaluation** consists of key elements that will be monitored as implementation of the forest plan progresses (future site-specific actions). Monitoring is part of an adaptive management process that measures the performance of plan implementation against the goals and desired conditions and objectives to which it aspires. It also evaluates whether the implementation of standards and guidelines are producing the desired results.

## Other Plan Content

Other content in this plan includes the contents of chapter 1, certain sections of chapters 2 through 6 (background, other sources of direction, management approach, related plan content) and all appendices.

In addition to plan components, there are sections of the forest plan that include **general descriptions**, and **management approaches**.

**General Descriptions:** Explanatory narrative, descriptions of place, and other important information that supports the understanding of, or gives context to, plan decisions are described throughout the forest plan under this heading. General descriptions help managers and the public apply the direction within each of the plan components.

**Management Approaches:** Most sections of the forest plan include this additional content, which briefly describes the principal approaches to management that the responsible official is inclined to take. Management approaches do not make commitments of resources. They may illustrate suggestions as to how desired conditions or objectives could be met, convey a sense of priority among objectives, or indicate a possible future course of change to a program; partnership opportunities and collaborative arrangements may be discussed, as well as potential processes such as further analysis or inventory. The wording structure of management approaches is characterized with a verb ending in "ing" (such as managing, cooperating, conducting, or collaborating).

[7] Refer to 16 U.S.C. 1604(k)

## Implementation of the Forest Plan

The following transition direction is provided to ensure the orderly implementation of the revised forest plan that is specified in the record of decision. The new direction will apply to all project decisions made on or after the effective date of the record of decision. The new direction does not apply to any project decisions made prior to the effective date of the record of decision. Projects currently under contract, permit, or other authorizing instrument are not affected by the decision; however, projects may be modified to adopt all or part of this direction where Forest Service managers deem appropriate. Reissuance of existing authorizations will be treated as new decisions, which must be consistent with the new direction described in this revised plan subject to valid existing rights.

As required by the National Forest Management Act and the 2012 Planning Rule, subject to valid existing rights, all projects and activities authorized by the Forest Service after approval of this revised forest plan must be consistent with the applicable plan components (16 U.S.C. 1604(i)) as described at 36 CFR 219.15 of the 2012 Planning Rule. (Although the transition provisions at 36 CFR 219.17 of the 2012 Planning Rule allow revision of this plan under the 1982 regulations, subsequent projects or activities approved on units with plans revised under a prior planning rule must comply with the consistency requirement at 219.15 of the current planning rule.)

Consistency with this plan will be attained by developing management activities that are designed specifically to achieve the desired conditions and objectives of the plan and are guided by relevant standards and guidelines. To the extent practicable, documentation for such projects should identify the elements of the desired conditions, goals, or objectives to be achieved by the project. It should not be expected that all projects or activities would contribute to all desired conditions, goals, or objectives, but rather to a limited subset. It should also be recognized that some projects designed to contribute to some desired conditions, goals, or objectives may have consequences considered adverse to the achievement of other desired conditions, goals, or objectives. In this situation, the responsible official for the project needs to identify and disclose these effects in the project documentation and make a decision that balances these considerations.

A project or activity approval document must describe how the project or activity is consistent with the forest plan by the criteria listed at 36 CFR 219.15(d) in the 2012 Planning Rule. Where a proposed project or activity would not be consistent with plan direction, the responsible official has the following options as described in section 219.15(c) of the Rule:

1. Modify the proposed project or activity to make it consistent with the applicable plan components;
2. Reject the proposal or terminate the project or activity;
3. Amend the plan so that the project or activity will be consistent with the plan as amended;
4. Amend the plan contemporaneously with the approval of the project or activity so that the project or activity will be consistent with the plan as amended. This amendment may be limited to apply only to the project or activity, and may be adopted at the same time as the approval of the project or activity (see section 219.15(c)(4) of the Rule).

Any resource plans (such as travel management plans) developed by the Forest Service that apply to the resources or land areas within the planning area must be consistent with the plan components. Resource plans developed prior to the plan record of decision must be evaluated for consistency with the plan and amended if necessary (see section 219.15(e) of the Rule).

Authorizations for occupancy and use made before the final record of decision may proceed unchanged until time of reauthorization. At time of reauthorization, all permits, contracts, and other authorizing instruments must be made consistent with the revised plan, subject to existing valid rights, as provided at section 219.15(d) of the Rule.

A forest plan is used as a direction source for future projects, plans, and assessments. It is not expected that this new direction be used to reevaluate or change decisions that have been made under the 1986 forest plan. A smooth and gradual transition to the new forest plan is anticipated, rather than one that forces an immediate reexamination or modification of all contracts, projects, permits, and other activities that are already in progress. As new project decisions, contracts, permits, renewals, and other activities are considered, conformance to the revised forest plan direction is expected.

## Changes to the Forest Plan

A change to the forest plan requires either administrative correction or amendment. The following summarizes circumstances that warrant corrections or amendments to the forest plan.

**Administrative changes** are minor changes to the forest plan that do not substantively affect the management direction or create additional environmental consequences. These minor changes include the following:

- Corrections of clerical errors to any part of the plan;
- Conformance of the plan to new statutory or regulatory requirements;
- Changes to elements of the plan that are not plan decisions as described in the “Other Plan Content” section above;
- Changes to the plan monitoring strategy, after notice is made to the public of the intended change and consideration has been given to public comment and feedback;
- Corrections and updates of data published in the forest plan and minor changes to maps of management areas; and
- Changes in projections of timber management activities expected to occur during the plan period.

An administrative change must be initially published as a proposed change either on the Coronado National Forest website or in a local newspaper of record. The proposed change must identify the language or map to be corrected, the proposed change, and the reason for the correction. The public will have an opportunity to comment on the proposed change within a 30-day period following publication. After reviewing the comments received, the final change may be similarly published and the forest plan corrected.

**Site-specific forest plan amendments** occur to allow specific projects or other activities to deviate from certain forest plan direction. These amendments occur only for a specific area or a specific project. They do not lead to permanent changes in forest plan language, and if changes (project-specific variances) are made to management area map layers, they are made only for the area affected. Such amendments are usually proposed with appropriate National Environmental Policy Act environmental analysis for the site-specific project proposal. The procedures for processing a site-specific plan amendment are outlined in the applicable planning regulation.

**Programmatic forest plan amendments** permanently change the text and language of the forest plan decisions identified in the earlier section “Forest Plan Decisions” for all future projects. The

procedures for addressing a programmatic plan amendment are outlined in the applicable planning regulation.

## Forest Plan Maps

The forest plan includes maps throughout the document. The following statement applies to all maps found within the forest plan.

> DISCLAIMER: Acreage calculations are dependent on data sources, projections, methods of calculation, and changes in technology. Data sources have changed over the years. The sources of data have improved with technology like GPS and digital survey equipment. Data projections have changed over the years giving us better measurement of length and area. Map data is almost always measured in a planer (flat, maps are flat) projection that yields accurate measurement of area for small areas, but returns a less accurate area calculation over large areas because the curvature of the earth is not accounted for in a planer projection, because of this inaccuracy many small area calculations don't always add up to the sum of a larger single area. Many times the difference is only fractions of an acre, other times with large areas the difference can be a few aces. With this GIS acreage, calculations may vary over time depending on data, projections, and technology. The current GIS area calculations are the best we have with the available data and technology at this time and may not reflect the same exact numbers of past or future calculations.

# Chapter 2. Forestwide Management

## Introduction

This chapter describes management direction (plan decisions and other content) that applies to each resource or subject area wherever it occurs across the Coronado National Forest. Each subject area includes a general description followed by one or more plan components and recommended management approaches. See chapter 1 for descriptions of plan decisions and other content.

Throughout this chapter, forest plan decisions (desired conditions, objectives, standards, and guidelines) are displayed within gray borders. Text outside of these areas are not plan decisions; such text consists of other plan content such as general descriptions, background material, explanations, and/or descriptions of management approaches.

In the event of conflicts with other sections of this plan, the more restrictive plan decision generally applies. However, a project- or activity-level evaluation may be required to resolve the conflict. Plan decisions and other content for management areas (chapter 3), geographic areas (chapter 4), and suitability (chapter 5) should also be consulted.

## Response to Climate Change

### General Description

The climate of the southwestern United States is often referred to as dry and hot, but variation in topography, seasonal monsoons, and the strong influence of the El Niño Southern Oscillation and other large-scale circulation patterns add complexity to this region (see appendix A). While low deserts of the Southwest experience heat and drying winds in the early summer, forested mountain areas and plateaus may experience cold and drifting snow during winter. Monsoon thunderstorms in July and August are often accompanied by flash flooding, while from fall to spring, the weather can be warm with clear skies. Precipitation patterns are characterized by two peaks each year; winter precipitation is produced primarily from large frontal systems moving over the region, whereas summer precipitation results largely from thunderstorms within the North American monsoon circulation. The Southwest also experiences periods of short- and long-term drought, often linked to anomalies in El Niño.

Data shows that average air temperatures across the globe are rising (IPCC 2007). Details and supporting literature regarding impacts of climate change for the Southwest are summarized in appendix A. In summary, by the end of the 21st century, the Southwest, including the Coronado National Forest, is likely to experience:

- temperature increases of 5 to 8 degrees Fahrenheit (or about half a degree Fahrenheit per decade on average);
- an increase in the number of hot days, with summer heat waves lasting 2 weeks or longer;
- warmer winters with reduced snowpack;
- a later monsoonal season;
- a 10 percent drop in annual precipitation in southern Arizona, and
- an increase in extreme flood events following an overall increase in tropical storms.

The potential ecological implications of climate change trends in the Southwest indicate the following (see appendix A):

- More extreme disturbance events, including wildfires, intense rain, flash floods, and wind events.
- Greater vulnerability to invasive species, including insects, plants, fungi, and vertebrates.
- Long-term shifts in vegetation patterns. Cold-tolerant vegetation moving upslope or disappearing in some areas. Migration of some tree species to the more northern portions of their existing range.
- Potential decreases in overall forest productivity due to reduced precipitation.
- Shifts in the timing of snowmelt (already observed) and increases in summer temperatures affecting the survival of fish species and efforts to reintroduce species into their historic range.
- Effects on phenology and changes in the date of flowering and associated pollination and food chain disruptions.
- Ecosystems and species that may be particularly vulnerable to climate change include:
    - **Sky island forests (spruce-fir, dry and wet mixed conifer, ponderosa pine-evergreen oak, Madrean pine-oak woodland).** These high elevation systems contain plant and animal species that are adapted to cooler climates. They are highly fragmented, so species cannot easily migrate to areas that are more suitable. They could become more fragmented in the future as suitable climates shift upward in elevation, reducing overall habitat size. These systems also contain many threatened and endangered species, and can be at particular risk for severe wildfires and insect outbreaks.
    - **Aquatic, wetland, and riparian systems.** These systems also contain many threatened and endangered species. They are highly dependent on water and, thus, are highly vulnerable to shifts in precipitation regimes. They may be further threatened by increased human demand for water used in grazing, agriculture, and municipal drinking water. Many species are also physiologically dependent on narrow temperature ranges as well.
    - **Species expected to be negatively affected by climate change.** A recent wildlife vulnerability assessment found several vertebrate species to be vulnerable to climate change, including the Tarahumara frog, Mount Graham red squirrel, Chiricahua squirrel, elegant trogon, and Chiricahua leopard frog (Coe et al. 2011). Additional species, including plants and invertebrate species may also be vulnerable, especially those with narrow ranges that are not adapted to frequent disturbance.

Potential social and economic effects of climate change trends in the Southwest and the Coronado National Forest indicate the following (see appendix A):

- Potential decrease in forage and water availability for livestock.
- Increased recreation on the Coronado National Forest, where cooler temperatures will attract people to higher elevations as a refuge from increasingly hot summers.
- Greater numbers of diseases that favor warmer climates, heat-induced illnesses, reduced air quality, and increased cases of respiratory illness.
- Greater energy demands for cooling systems that could place greater pressure for permits for alternative energy on National Forest System lands.
- Increased pressures on the region’s already limited water supplies.

Based on current climate model projections and research, the climate change factors that appear most likely to affect desired conditions in the revised land management plan on the Coronado National Forest are ecological, weather-related disturbances, and socioeconomic demands:

- Projected increase in frequency of extreme weather events (intense storms).
- Projected increase in wildfire risks.
- Projected increase in outbreaks of insects, diseases beyond endemic levels, and nonnative invasive species.
- Projected increase in demand for deceasing upland water supplies.

## Desired Conditions for the Coronado National Forest's Response to Climate Change

Ecosystems retain their functions under changing and uncertain future environmental conditions. Coronado National Forest landscapes retain the capacity to survive natural disturbances and threats to sustainability such as those driven by climate change and an increasing human population with local and regional needs. Ecosystem functions (such as nutrient cycling, water infiltration, and carbon sequestration) are sustained as forests, woodlands, grasslands, and desert communities adapt to warmer, drier conditions. Ecosystems are resilient to changing natural disturbance regimes (such as drought, wind, fire, insects, and pathogens), allowing for adaptation of plant communities, structure, and ages across the landscape.

Ecological conditions for habitat quality, distribution, and abundance contribute to self-sustaining populations of terrestrial and aquatic plants and animals. Conditions provide for the life history, distribution, and natural population fluctuations of species within the capability of the ecosystem. Contiguous blocks of habitat are interconnected, support a wide array of native species, and allow for genetic and behavioral interactions. Ecological processes allow connectivity of predator-prey relationships, metapopulations, and interactive wildlife species throughout the landscape. Habitat quality, distribution, and abundance exist to support recovery and/or stabilization of federally listed and other species.

The Coronado continues to provide services for human uses, including recreation, grazing, forest products, and water resources. Recreation sites, such as campgrounds, are located in areas not at risk to flash flooding. Increased visitation to the Coronado to escape the summer heat is done so in a sustainable way so as not to decrease the natural character of the landscape. Water resources are made available for multiple uses and used sustainably.

## Management Approaches

- **Anticipating and planning for disturbances from intense storms.** Planning for intense storms includes controlling soil erosion, relocating high-risk roads and trails, and constructing appropriately sized culverts and stream crossings. It includes using a suite of adaptation options to manage ecosystems in the face of uncertainty. Options include increasing resistance to disturbances by preventing fires in nonadapted desert communities and pest invasions, promoting resilience of ecosystems so they return to their previous condition following a disturbance, and allowing ecosystems to respond to climate change by facilitating species and ecosystem migration.
- **Increasing water conservation and planning for reductions in upland water supplies.** This includes identifying the water rights status of water resources (for range, wildlife, public drinking systems), water for fire management activities, recreational uses, and aquatic

habitats; and reviewing the status of State and regional water plans, forest and watershed health plans, and integrated regional water planning efforts.

- **Anticipating increased forest recreation use.** This includes planning for higher visitor use to escape the summer heat and making facilities and roads available to accommodate demands. It also includes anticipating changes in types of recreational uses, such as a decrease in snow related recreation due to a shorter snow season.
- **Monitoring climate change influences and the effectiveness of adaptation approaches.** This includes taking advantage of existing monitoring plans to look for climate change related signals and making use of research natural areas to monitor additional impacts. It also includes monitoring the effectiveness of adaptation approaches so adjustments can be made when needed.

## Vegetation Communities

### General Description

Nine major vegetation communities are identified within the Coronado National Forest boundary (includes lands that are not national forest). Table 1 displays the acreage and relative percentage of these vegetation communities. Forest vegetation maps are located on the Coronado National Forest website under background documents at:
https://www.fs.usda.gov/detail/coronado/landmanagement/planning/?cid=fswdev7_018702

**Table 1. Major vegetation communities within the Coronado National Forest boundary**

| Vegetation Community | Percent Composition | Acres |
|---|---|---|
| Madrean encinal woodland | 43.0 | 738,693 |
| Grassland communities | 23.7 | 407,477 |
| Desert communities | 10.2 | 175,452 |
| Interior chaparral | 8.8 | 151,181 |
| Madrean pine-oak woodland | 8.3 | 142,047 |
| Mixed conifer (wet and dry) | 3.2 | 55,451 |
| Ponderosa pine-evergreen oak | 2.3 | 39,477 |
| Spruce-fir forest | 0.2 | 3,014 |
| Montane meadows, wetlands, and riparian areas | 0.2 | 5,142 |
| Total | 100.0 | 1,717,934 |

Desert communities include both the Sonoran and Chihuahuan Deserts. The grassland vegetation community includes desert, plains, and savanna grasslands. The term “encinal” refers to oak communities. Mixed conifer includes both dry and wet mixed conifer types. Desert communities, grasslands, interior chaparral, Madrean encinal woodlands, and Madrean pine-oak woodlands compose approximately 94 percent of the total area of the Coronado National Forest. Of this, Madrean encinal woodlands account for approximately 43 percent, and grasslands represent about

23.7 percent. In contrast, the combined area of montane meadows, wetlands, riparian areas, ponderosa pine-evergreen shrub, mixed conifer forest, and spruce-fir forest compose around 6 percent of the total area of the Coronado National Forest.

Riparian communities range across all elevation gradients, from deserts to subalpine forests, spanning a variety of characteristic vegetation communities. Therefore, riparian communities are composed of various plant species dependent upon the elevation and upland vegetation community type in which they are found. There are three primary riparian associations on the Coronado National Forest: cottonwood-willow riparian forest (in deserts and grasslands), mixed broadleaf deciduous riparian forest (in oak and pine woodlands), and montane willow riparian forest (in mixed conifer forests).

Vegetation desired conditions are described at multiple scales when possible. The three scales used herein are landscape scale, mid-scale, and fine scale. Descriptions at these various scales are necessary to provide adequate detail and guidance for the design of future projects and activities that will help achieve the desired conditions over time. In some cases, not enough information is available to provide descriptions at multiple scales. Descriptions begin with the landscape scale to provide the "big picture" desired conditions across the larger land area. Descriptions at the mid-scale and fine scale provide additional detail necessary for guiding future projects and activities.

Landscape scale is typically composed of variable elevations, slopes, aspects, soils, plant associations, and ecological and disturbance processes. On the Coronado National Forest, multiple vegetation communities make up the landscape scale. Almost no community is monotypic at this scale, but each gradually merges with the surrounding vegetation communities. An area at the landscape scale is comprised of multiple mid-scale units. Mid-scale is composed of assemblages of fine scale units that have similar biophysical conditions. Fine scale is composed of individual biophysical features, such as a group of trees or shrubs, natural springs, or other features.

## Desired Conditions

### *Landscape Scale*

Landscapes provide for the full range of ecosystem diversity at multiple scales and are composed of multiple vegetation communities. Each vegetation type contains a mosaic of vegetative conditions, densities, and structures. This mosaic occurs at a variety of scales across landscapes and watersheds. The distribution of physical and biological conditions is appropriate to the natural disturbance regimes affecting the area. Vegetative conditions are resilient to the frequency, extent, and severity of disturbances under a changing climate, especially fire. Natural and human disturbances (such as planned and unplanned fire, mechanical vegetation treatments) provide desired overall plant density, structure, species composition, coarse woody debris, and nutrient cycling. Desired disturbance regimes are restored.

Native plant communities dominate the landscape, while invasive species are nonexistent or in low abundance. Establishment of invasive plant species new to the Coronado National Forest is prevented, even as climate change may favor new invaders. In the event of nonnative insect and pathogen establishment, native vegetation communities are preserved and ecosystem function is maintained. Vegetation attributes, including appropriate densities, provide favorable conditions for water flow and quality. The composition, abundance, and mosaic of organic ground cover and herbaceous vegetation protects soil, provides moisture infiltration, and contributes to plant and animal diversity and ecosystem function.

Vegetation provides socially and economically valued products, such as wood fiber or forage, for local and regional needs. Managed herbivory (the act of feeding on plants) aids in sustaining or improving native vegetation cover and composition. Livestock grazing and wood fiber harvest activities contribute to aspects of the social, economic, and cultural structure and stability of rural communities.

Ecological conditions provide habitat characteristics necessary for associated federally listed species and rare and culturally important plant species. Habitat conditions provide for survival and recovery of species listed under the Endangered Species Act, and contribute to their delisting.

### *Mid-Scale*

The composition, density, structure, and mosaic of vegetative conditions minimize the threat of uncharacteristic wildfire hazard to local communities and ecosystems (see “Wildland-Urban Interface” on page 23). In woodland and forested vegetation communities, declining trees provide snags and coarse woody debris. Snags and coarse woody debris are well distributed throughout the landscape. The condition and characteristics of habitats for proposed or candidate species help preclude species listed as threatened or endangered under the Endangered Species Act. Potentially suitable habitat for sensitive plant species helps retain functional stability of the species.

Forest conditions in goshawk post-fledging areas are similar to general forest conditions, except that these forests contain 10 to 20 percent higher basal area in the mid-age to old tree groups than goshawk foraging areas and the general forest. Goshawk nest areas have forest conditions that are multi-aged, but are dominated by large trees with relatively dense canopies.

### *Fine Scale*

Endemic rare plant communities are intact and functioning. Unique plant communities (such as limestone cliffs, margins of seeps and springs, talus slopes, mesquite bosques, cienegas, sacaton riparian grasslands, montane meadows, canyons, cliffs, and ledges) are present and provide habitats and refugia for associated native plant species in a changing climate.

Native plants, including rare plant species, provide nectar, floral diversity, and pollen throughout the seasons that pollinator species are active, and promote pollinator success and survival.

## Standards

1. Public and firefighter safety will be the highest priority during all fire management activities.
2. The maximum size opening that may be created in one harvest operation to create an even-aged stand shall not exceed 40 acres except when it is following a large-scale disturbance event such as a stand-replacing fire, wind storm, or insect or disease outbreak.
3. When openings are created with the intent of regeneration, effort shall be made to ensure that lands can be adequately restocked within 5 years of final harvest.

## Guidelines

1. Project design should provide for wildlife movement between treated and untreated areas to increase available habitat.
2. Only native or nonpersistent, non-native seed and plant materials will be used when revegetating disturbed sites.
3. Management activities should favor the development of native grasses in areas where they have the potential to establish and grow.

4. Even-aged silvicultural practices may be used as a strategy for achieving the desired conditions over the long term, such as bringing mistletoe infection levels to within a sustainable range.

### Management Approach

Prioritizing existing invasive plant, insect, and pathogen species for eradication, containment, or control. Developing resistance in host species when eradication, containment, or control is not possible.

## Wildland-Urban Interface

### General Description

The wildland-urban interface includes those areas of human populations and their residences at imminent risk from wildfire, as well as human developments having special significance. The wildland-urban interface is represented in all vegetation communities on the Coronado. These areas may include critical communications sites, municipal watersheds, high-voltage transmission lines, church camps, scout camps, research facilities, and other structures that, if destroyed by fire, would result in hardship to communities. These areas encompass not only the sites themselves, but may also include the continuous slopes and fuels that lead directly to the sites, regardless of the distance involved. These areas may be particularly susceptible to increases in severity and intensity of wildfires and flash floods that are projected under a changing climate.

### Desired Conditions

As a result of vegetation management, most wildfires in the wildland-urban interface are low- to mixed-severity fires that result in limited loss of structures or ecosystem function. Patterns of treatments are effective in modifying fire behavior.

Wildland-urban interface residents and visitors are knowledgeable about wildfire protection measures for their homes and property, including defensible space. People using wildland-urban interface areas are educated about the potential danger of wildlife, particularly black bears and mountain lions, and measures they can take to prevent encounters.

Access to wildland-urban interface areas allows for increased safety and efficiency of wildfire suppression operations.

### Objective

1. Treat 5,000 to 10,000 acres in the wildland-urban interface using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication every year to reduce fire hazard and risk to communities and the national forest.

### Management Approaches

- Supporting the development and implementation of community wildfire protection plans.
- Encouraging landscape-scale planning for wildland fire management across jurisdictional boundaries.
- Educating property owners on the need to take primary responsibility for maintaining a defensible space around their property.

# Desert Communities

## General Description

Desert communities range in elevation from 2,600 to 3,200 feet, although they may extend beyond this range on steep southern exposures. Annual precipitation averages from 10 to 13 inches. The predominant species are shrubs, desert trees, and succulents, with lesser amounts of grasses and forbs. Common plant species occurring in desert communities include catclaw acacia, triangle bursage, littleleaf paloverde, mesquite, desert ironwood, creosote bush, desert broom, desert willow, brittlebush, desert zinnia, barrel cactus, hedgehog cacti, cholla and prickly pear cacti, saguaro, threeawn grasses, bush muhly, and club moss. Animal species occurring in the desert communities include desert bighorn sheep, kit fox, black-tailed jackrabbit, round-tailed ground squirrel, canyon bat, cactus wren, Gila woodpecker, Gambel's quail, desert tortoise, zebra-tailed lizard, Gila monster, desert spiny lizard, Sonoran coralsnake, Sonoran Desert toad, red-spotted toad, giant hairy scorpion, desert orangetip, and tarantulas. Gravel and rock cover ranges from 5 to 65 percent in flood plains, and from 35 to 85 percent on upland sites. Bedrock outcrops can be as high as 10 percent in uplands. Active erosion and sedimentation occurs in channels on flood plains.

Based on projections of future climate change for the region, conditions may favor desert communities as they are adapted to the hot, dry conditions that are likely to increase in the area. However, they are susceptible to increases in insect attacks, colonization by invasive species, longer and more severe fire seasons, and altered frequency, severity, timing, and spatial extent of disturbance events (such as droughts, fires, flash floods, landslides, and windstorms).

## Desired Conditions

### *Landscape Scale*

The predominant plant species are native shrubs and succulents. There is sparse to dense vegetation cover that includes cacti and agave species, desert grasses, desert scrub, and varying amounts of annual species. Fires are rare, with mean fire return intervals estimated at over 100 years. Ground cover consists primarily of gravel, cobble, and rock. Perennial plant basal area is low and ranges from 1 to 3 percent of the soil surface. Ephemeral cover of annual forbs and grasses can be high after exceptionally wet winter or summer seasons. Plant litter occupies 5 to 30 percent of the soil surface. There are no signs of compaction or accelerated erosion. The ability of soil to maintain resource values and sustain outputs is high. Native vegetation structure and composition provide habitat for animal species that live in this vegetation community. Traditional food and material plants thrive here, including bluedicks, careless weed, sotol, ephedra, yucca, buckhorn cholla, tulip prickly pear, limberbush, creosote bush, mesquite, and saguaro.

### *Mid-Scale*

On steep hillslopes, ridgetops, and moderately sloping pediments where soils have formed in place on acid igneous and related metamorphic parent materials like granite, gneiss, and rhyolite, the predominant species are foothill paloverde, saguaro, prickly pear, cholla, hedgehog cactus, ocotillo, coursetia, limber bush, false mesquite, brittlebush, triangle bursage, bush muhly, tanglehead, slender grama, purple threeawn, janusia, and spike moss.

Annual forbs and grasses fluctuate with precipitation from nearly nothing in dry years to several hundred pounds per acre in wet years.[8] Plant basal cover ranges from 1 to 3 percent, and cover by plant litter ranges from 5 to 30 percent. Canopy cover ranges from 0 to 10 percent for grasses, 1 to 10 percent for forbs, and 2 to 15 percent for shrubs and succulents. Tree canopy cover is 1 to 10 percent.

On moderately steep hillsides and fan piedmonts where alkaline soils are formed in alluvium from mixed parent materials, the predominant species are foothill paloverde, saguaro, prickly pear, cholla, barrel cactus, ocotillo, false mesquite, triangleleaf bursage, bush muhly, slender grama, curly mesquite, spidergrass, tanglehead, purple threeawn, janusia, ayenia, and globe mallow. Annual forbs and grasses fluctuate with precipitation from nearly nothing in dry years to several hundred pounds per acre in wet years. Plant basal cover ranges from 1 to 3 percent, and cover by plant litter ranges from 10 to 75 percent. Canopy cover ranges from 1 to 20 percent for grasses, 1 to 15 percent for forbs, and 5 to 20 percent for shrubs and succulents. Tree canopy cover is 1 to 10 percent.

On moderately steep hillsides and fan piedmonts where nonalkaline soils are formed in alluvium from mixed parent materials, the predominant species are foothill paloverde, saguaro, prickly pear, cholla, ocotillo, whitethorn acacia, creosote bush, false mesquite, range ratany, desert zinnia, bush muhly, black grama, slim tridens, fluff grass, janusia, desert senna, and twinberry. Annual forbs and grasses, an important part of this plant community, fluctuate with precipitation from nearly nothing in dry years to several hundred pounds per acre in wet years. Plant basal cover ranges from 1 to 3 percent, and cover by plant litter ranges from 5 to 45 percent. Canopy cover ranges from 1 to 10 percent for grasses, 1 to 10 percent for forbs, and 5 to 20 percent for shrubs and succulents. Tree canopy cover is 1 to 10 percent.

On nearly level floodplains, low stream terraces, and canyon bottoms where soils are formed in recent alluvium from mixed parent materials, the predominant species are foothill and blue paloverde, mesquite, catclaw acacia, desert willow, desert hackberry, wolfberry, big bursage, burrobrush, desert honeysuckle, bush muhly, sand and spike dropseed, sideoats grama, tanglehead, spidergrass, and mesa threeawn. Annual forbs and grasses fluctuate with precipitation from nearly nothing in dry years to several hundred pounds per acre in wet years. Plant basal cover ranges from 2 to 5 percent, and cover by plant litter ranges from 5 to 45 percent. Canopy cover ranges from 10 to 20 percent for grasses, 1 to 15 percent for forbs, and 5 to 15 percent for shrubs and succulents. Tree canopy cover is 10 to 15 percent.

### Objective

1. Suppress or eradicate buffelgrass[9] on 1,000 to 1,500 acres of Sonoran Desert every year using herbicides and manual methods.

[8] Quantitative bounds for production of annual grasses and forbs are site specific and can be found in the appropriate NRCS Ecological Site Description. Refer to appendix D of the forest plan environmental impact statement for more information.

[9] Buffelgrass (Penisetem ciliare) is an aggressive invasive perennial African grass that has infested thousands of acres of the Sonoran Desert in southern Arizona, including the lower elevations on the Coronado National Forest. It threatens native communities by competitive exclusion and increased frequency of uncharacteristic fires.

### Guidelines

1. Ground-disturbing activities that occur in an area occupied by buffelgrass should include measures to eradicate or limit the spread of buffelgrass during or following the activity and implement measures to limit the potential for its spread into unoccupied areas.
2. Wildland fire (planned or unplanned ignitions) should not be used as a management activity in desert communities, except as a strategy to control invasive vegetation.
3. Vegetation treatments in desert communities should provide for maintaining a sustainable population of paniculate agaves. [10]

### Management Approaches

1. Considering the Arizona Interagency Desert Tortoise Team's Recommended Standard Mitigation Measures when designing projects.
2. Supporting or assisting partners in monitoring Sonoran Desert plants and animals and their habitats in areas within or near the national forest boundary.

## Grassland Communities

### General Description

Grasslands[11] on the Coronado National Forest include semidesert, plains, and savanna grasslands. Elevations range from 3,200 to 4,600 feet in the semidesert grassland communities, although they may extend beyond this range on steep southern exposures. Annual precipitation averages from 12 to 16 inches. Ground cover consists mainly of gravel, cobble, and rock, ranging from 15 to 65 percent on steep and moderate slopes, and 10 to 35 percent in bottom lands. Bedrock outcrops can be as high as 15 percent on steep and moderate slopes, with the exception of moderate slopes with limestone parent material where bedrock outcrops range from 0 to 5 percent. In washes and bottom lands, bedrock outcrops are 2 percent or less. Channel areas are active with both erosion and sedimentation.

Elevations range from 4,000 to 5,500 feet in the plains grassland and savanna communities, although they may extend beyond this range on steep southern exposures. Annual precipitation averages from 16 to 20 inches. Ground cover by gravel, cobble, and rock ranges from 10 to 57 percent, except in bottom lands with loamy soils. Bedrock outcrops can be as high as 10 percent in steeper areas.

Animal species occurring in the grassland communities include pronghorn, American badger, plains harvest mouse, scaled quail, black-throated sparrow, Botteri's sparrow, ornate box turtle, Mexican hog-nosed snake, round-tailed horned lizard, desert grassland whiptail, Sonoran spotted whiptail, Great Plains toad, plains spadefoot, and horse lubber grasshopper. Based on projections of future climate change for the region, habitat suitable for grasslands could increase as warmer, drier conditions will most likely be more common. However, grassland ecosystems are susceptible to decreases in plant productivity from water limitations and increased heat, increases in insect attacks, colonization by invasive species, longer and more severe fire seasons, and altered frequency, severity, timing, and spatial extent of disturbance events (such as droughts,

[10] Paniculate agaves are species in the subgenus Agave having branched inflorescence with flowers born in umbellate clusters on lateral branches.

[11] The grassland community spans a wide range of precipitation zones within the Coronado National Forest. The gradient from semidesert to plains to savanna grasslands correlates incrementally to higher precipitation zones.

flash floods, and landslides). Grasses make use of moisture in the upper soil layers. Intense precipitation events may lead to increased runoff, but decreased effective water infiltration. This could decrease vigor of native plants and lead to increased colonization of nonnative invasive plant species.

## Desired Conditions: Semidesert Grassland

### *Landscape Scale*

In the semidesert grassland communities, the predominant species are native grasses. There is moderate to dense vegetation cover that includes desert grasses and forbs, succulent species, subshrubs, and some herbaceous cover of annuals. Species include hairy grama, black grama, blue grama, sideoats grama, tanglehead, plains lovegrass, curly mesquite, spidergrass, purple and blue threeawn, slim tridens, spreading ratany, false mesquite, velvet-pod and catclaw mimosa, prickly pear, agave, ocotillo, shin-dagger, and sotol. Fires are common, with mean fire return intervals estimated between 10 and 25 years. Plant basal area ranges from 5 to 15 percent of the soil surface. Plant litter occupies 5 to 45 percent of the soil surface. Tree canopy and shrub cover averages 0 to 10 percent. There are no signs of compaction or accelerated erosion. The ability of soil to maintain resource values and sustain outputs is high. Native vegetation structure and composition provide habitat for animal species that live in this vegetation community. Traditional food and material plants thrive here, including pigweed, coyote melon, canaigre, sacaton, agave species, sotol, ocotillo, soaptree and banana yuccas, staghorn cholla, Engelmann prickly pear, oneseed juniper, and mesquite.

### *Mid-Scale*

On steep hillslopes and ridgetops where soils have formed in place on acid igneous and metamorphic parent materials like granite, rhyolite, gneiss, schist, and quartzite, the potential native plant community is dominated by perennial grasses and subshrubs, with lesser amounts of large shrubs and succulents. The predominant species are black, sideoats, slender, sprucetop, Santa Rita and hairy gramas, tanglehead, cane beardgrass, plains lovegrass, ocotillo, sotol, kidneywood, mimosa species, false mesquite, shrubby buckwheat, dalea, shin-dagger, agave, wire lettuce, penstemon, and ferns. Plant basal cover ranges from 5 to 12 percent, and cover by plant litter ranges from 25 to 40 percent. Canopy cover ranges from 20 to 50 percent for perennial grasses, 1 to 10 percent for forbs, and 10 to 15 percent for shrubs and succulents. Tree canopy cover is 0 to 2 percent and may include species like oneseed juniper, mesquite, and Arizona rosewood.

On moderately sloping pediments where soils have formed in place on acid igneous and metamorphic parent materials like granite, gneiss, schist, and rhyolite, the potential native plant community is dominated by perennial grasses and subshrubs, with lesser amounts of large shrubs and succulents. The predominant grama species are black, sideoats, slender, sprucetop, Santa Rita, and hairy grama; other species include tanglehead, Arizona muhly, curly mesquite, ocotillo, false mesquite, range and spreading ratany, shrubby buckwheat, dalea, agave, mimosa species, wire lettuce, penstemon, trailing four o'clock, spike moss, and shrubby deervetch. Plant basal cover ranges from 6 to 15 percent, and cover by plant litter ranges from 25 to 40 percent. Canopy cover ranges from 20 to 50 percent for perennial grasses, 0 to 3 percent for forbs, and 10 to 25 percent for shrubs and succulents. Tree canopy cover is 0 to 2 percent and may include species like oneseed juniper and mesquite.

On steep hillslopes, ridgetops, and mesas where soils have formed in place on basic and intermediate igneous parent materials like basalt, andesite, and welded volcanic tuff and ash, the

plant community is dominated by native perennial grasses, with lesser amounts of shrubs and succulents. The predominant species are sideoats grama, cane beardgrass, plains lovegrass, green sprangletop, purple and hairy gramas, curly mesquite, tanglehead, ocotillo, mimosa species, false mesquite, shrubby buckwheat, shin-dagger, agave, prickly pear, penstemon, bluedicks, globe mallow, and ferns. Plant basal cover ranges from 5 to 15 percent, and cover by plant litter ranges from 25 to 55 percent. Canopy cover ranges from 25 to 65 percent for perennial grasses, 1 to 10 percent for forbs, and 5 to 15 percent for shrubs and succulents. Tree canopy cover is 0 to 2 percent and may include species like oneseed juniper, mesquite, and netleaf hackberry.

On steep hillslopes and ridgetops where soils have formed in place on limestone parent materials, the plant community is dominated by native perennial grasses, shrubs, and succulents. The predominant species are sideoats grama, black grama, slim tridens, tanglehead, Hall's panic, New Mexico feathergrass, ocotillo, mariola, false mesquite, feather dalea, whitethorn acacia, sandpaper bush, creosote bush, twinberry, sotol, shin-dagger, banana yucca, prickly pear, bahia, dogweed, croton, bladderpod, and ferns. Plant basal cover ranges from 3 to 8 percent, and cover by plant litter ranges from 10 to 25 percent. Canopy cover ranges from 15 to 30 percent for perennial grasses, 1 to 10 percent for forbs, and 15 to 40 percent for shrubs and succulents. Tree canopy cover is 0 to 5 percent and may include species like oneseed juniper, mesquite, and rosewood.

On moderately steep hillsides and fan piedmonts where soils have formed in loamy alluvium from mixed sources, the plant community is dominated by native perennial grasses and subshrubs, with lesser amounts of large shrubs and succulents. The predominant grama species are sideoats, slender, black, sprucetop, and hairy grama; other species include tanglehead, cane beardgrass, plains lovegrass, wolftail, spidergrass, purple threeawn, false mesquite, range ratany, shrubby buckwheat, agave, prickly pear, barrel cactus, banana yucca, globe mallow, bluedicks, and wire lettuces. Plant basal cover ranges from 6 to 15 percent, and cover by plant litter ranges from 10 to 50 percent. Canopy cover ranges from 20 to 60 percent for perennial grasses, 1 to 15 percent for forbs, and 2 to 20 percent for shrubs and succulents. Tree canopy cover is 0 to 1 percent and may include species like oneseed juniper, catclaw acacia, and mesquite.

On moderately steep hillsides, fan piedmonts, and ballenas where soils have formed in coarse loamy, calcareous alluvium and colluviums, the plant community is dominated by native perennial grasses, shrubs, and succulents. The predominant species are sideoats grama, black grama, bush muhly, slim tridens, tanglehead, Hall's panic, spike pappusgrass, blue threeawn, ocotillo, condalia, mariola, false mesquite, range ratany, feather dalea, Wright's beebrush, Mormon tea, twinberry, desert zinnia, banana yucca, prickly pear, bahia, dogweed, croton, paperflower, and trailing four o'clock. Plant basal cover ranges from 6 to 15 percent, and cover by plant litter ranges from 10 to 50 percent. Canopy cover ranges from 20 to 60 percent for perennial grasses, 1 to 5 percent for forbs, and 5 to 30 percent for shrubs and succulents. Tree canopy cover is 0 to 1 percent and may include species like oneseed juniper and mesquite.

On nearly level flood plains, low stream terraces, and canyon bottoms where soils are formed in recent alluvium from mixed parent materials, the plant community is dominated by native trees and shrubs with lesser amounts of perennial grasses, vines, and forbs. The predominant species are mesquite, catclaw acacia, desert willow, blue paloverde, netleaf hackberry, western soapberry, burrobrush, desert honeysuckle, clematis, greythorn, sacaton, bush muhly, sand and spike dropseed, sideoats grama, shortleaf tridens, tanglehead, green sprangletop, plains bristlegrass, spidergrass, mesa threeawn, coyote melon, canaigre, pigweed, morning-glory, ragweed, and wishbone bush. Plant basal cover ranges from 6 to 17 percent, and cover by plant litter ranges from 30 to 75 percent. Canopy cover ranges from 15 to 50 percent for grasses, 1 to 15 percent for

forbs, and 2 to 20 percent for shrubs and succulents. Tree canopy cover ranges from 15 to 30 percent.

## Desired Conditions: Plains Grassland and Savanna Grassland

### *Landscape Scale*

In the plains grassland and savanna communities, the predominant species are native perennial grasses. There is moderate to dense vegetation cover that includes mid-sized and short grasses and forbs, succulent species, subshrubs, taller shrubs, and some trees. Species occurring in plains grassland and savanna communities include sacaton, sideoats grama, purple grama, blue grama, hairy grama, black grama, curly mesquite, plains lovegrass, bullgrass, cane beardgrass, green sprangletop, Texas bluestem, crinkleawn, wooly bunchgrass, beggartick threeawn, spreading ratany, false mesquite, velvet-pod and catclaw mimosa, Parry agave, Palmer's agave, beargrass, sotol, cliffrose, mountain mahogany, oak, and juniper species. Fires are common, with mean fire return intervals estimated between 5 and 20 years. Plant basal area ranges from 10 to 20 percent of the soil surface. Plant litter occupies 20 to 70 percent of the soil surface. Tree canopy and shrub cover average 0 to 10 percent. There are no signs of compaction or accelerated erosion. The ability of the soil to maintain resource values and sustain outputs is high. Native vegetation structure and composition provide habitat for animal species that live in this vegetation community. Traditional food and material plants thrive here, including sacaton, yerba mansa, Hopi tea, skunkbush, yerba de pasmo, annual sunflower, sotol, agave, yucca, beargrass, oak, walnut, mesquite, and juniper.

### *Mid-Scale*

On steep hillslopes and ridgetops where soils have formed in place on acid igneous and metamorphic parent materials like granite, rhyolite, gneiss, schist, and quartzite, the plant community is dominated by an open canopy of oak with an understory of native perennial grasses and subshrubs and lesser amounts of large shrubs and succulents. The predominant species are Emory oak, Mexican blue oak, Arizona white oak, sideoats grama, cane beardgrass, plains lovegrass, bullgrass, Texas bluestem, crinkleawn, wooly bunchgrass, ocotillo, beargrass, sotol, mimosa species, manzanita, Gregg's dalea, California bricklebush, coralbean, skunkbush, turpentine bush, shrubby buckwheat, Palmer's agave, trailing fleabane, and ferns. Plant basal cover ranges from 10 to 18 percent, and cover by plant litter ranges from 35 to 70 percent. Canopy cover ranges from 15 to 45 percent for perennial grasses, 1 to 10 percent for forbs, and 1 to 5 percent for shrubs and succulents. Tree canopy cover is 5 to 25 percent, composed primarily of live oak species but including species like alligator and oneseed junipers, border piñon, mesquite, and Arizona rosewood.

On moderately sloping pediments where soils have formed in place on acid igneous and metamorphic parent materials like granite, gneiss, schist, and rhyolite, the plant community is dominated by native perennial grasses and subshrubs, with lesser amounts of large shrubs, trees, and succulents. The predominant species include oak and juniper, black, sideoats, slender, sprucetop, Santa Rita, and hairy gramas, wolftail, Arizona muhly, bullgrass, plains lovegrass, Orcutt's threeawn, ocotillo, false mesquite, spreading ratany, shrubby buckwheat, Gregg's dalea, yerba de pasmo, Palmer's agave, mimosa species, manzanita, skunkbush, beargrass, wire lettuce, penstemon, and snake cotton. Gravel and rock cover ranges from 15 to 65 percent. Plant basal cover ranges from 7 to 15 percent, and cover by plant litter ranges from 20 to 70 percent. Canopy cover ranges from 20 to 50 percent for perennial grasses, 0 to 2 percent for forbs, and 5 to 25 percent for shrubs and succulents. Tree canopy cover is 0 to 7 percent and may include species like Emory oak, Arizona white oak, alligator and oneseed junipers, and mesquite.

On steep hillslopes, ridgetops, mesas, and moderately sloping pediments where soils have formed in place on basic and intermediate igneous parent materials like basalt, andesite, and welded volcanic tuff and ash, the plant community is dominated by native perennial grasses, with lesser amounts of shrubs, trees, and succulents. The predominant species include Emory oak, Arizona white oak, alligator juniper, sideoats grama, cane beardgrass, plains lovegrass, green sprangletop, bullgrass, Texas bluestem, purple and hairy gramas, curly mesquite, tanglehead, ocotillo, mimosa species, whiteball acacia, yerba de pasmo, shrubby buckwheat, Palmer's agave, banana yucca, prickly pear, penstemon, bluedicks, vetch, and lotus. Plant basal cover ranges from 8 to 18 percent, and cover by plant litter ranges from 25 to 70 percent. Canopy cover ranges from 15 to 65 percent for perennial grasses, 1 to 15 percent for forbs, and 2 to 15 percent for shrubs and succulents. Tree canopy cover ranges from 5 to 15 percent, composed primarily of live oak and juniper species but including species like border piñon, mesquite, and netleaf hackberry.

On steep hillslopes, ridgetops, and scarps where soils have formed in place on limestone parent materials, the plant community is dominated by large native shrubs, with an understory of native perennial grasses, subshrubs, and succulents. The dominant species are mountain mahogany, cliffrose, Mearn's sumac, desert ceanothus, sideoats grama, wooly bunchgrass, crinkleawn, bullgrass, purple muhly, black grama, blue threeawn, rough tridens, tanglehead, Hall's panic, New Mexico feathergrass, ocotillo, false mesquite, feather dalea, sotol, banana yucca, prickly pear, Parry's agave, pectis, acalypha, blue penstemon, and ferns. Plant basal cover ranges from 5 to 10 percent, and cover by plant litter ranges from 20 to 50 percent. Canopy cover ranges from 15 to 40 percent for perennial grasses, 1 to 10 percent for forbs, and 10 to 30 percent for shrubs and succulents. Tree canopy cover ranges from 1 to 10 percent and may include species like alligator and oneseed juniper, Emory, Arizona white and Mexican blue oaks, mesquite, and rosewood.

On moderately steep hillsides, ridgetops, and saddles where soils have formed in loamy alluvium from mixed sources, the plant community is dominated by native perennial grasses and subshrubs, with lesser amounts of succulents and trees. Palmer's agave reaches its highest density on these areas. The predominant grama species are sideoats, sprucetop, and hairy grama; other species are wolftail, tanglehead, cane beardgrass, plains lovegrass, Texas bluestem, bullgrass, green sprangletop, false mesquite, yerba de pasmo, shrubby buckwheat, Palmer's agave, talinum, bundleflower, rosary bean, sida, evolvulous, bluedicks, and lotus. Plant basal cover ranges from 8 to 18 percent, and cover by plant litter ranges from 20 to 50 percent. Canopy cover ranges from 30 to 70 percent for perennial grasses, 1 to 20 percent for forbs, and 4 to 20 percent for shrubs and succulents. Tree canopy cover ranges from 0 to 10 percent and may include species like Emory, Arizona white and Mexican blue oaks, and alligator and oneseed junipers. Most trees occur on north aspects.

On moderately steep hillsides where soils have formed in coarse loamy, calcareous alluvium and colluviums, the plant community is dominated by perennial grasses, shrubs, and succulents. Sotol and beargrass are dominant and reach their highest densities on these sites. Other dominant species are sideoats grama, black grama, slim, rough and shortleaf tridens, tanglehead, Hall's panic, New Mexico feathergrass, wooly bunchgrass, crinkleawn, blue threeawn, ocotillo, false mesquite, range ratany, feather dalea, bahia, Hopi tea, blue penstemon, croton, scurfpea, and trailing four o'clock. Plant basal cover ranges from 8 to 18 percent, and cover by plant litter ranges from 10 to 50 percent. Canopy cover ranges from 30 to 70 percent for perennial grasses, 1 to 5 percent for forbs, and 4 to 30 percent for shrubs and succulents. Tree canopy cover ranges from 0 to 5 percent and may include species like Emory, Arizona white and Mexican blue oaks, and alligator and oneseed junipers. Most trees occur on north aspects.

On fan terraces, plains, and piedmonts where soils have formed in loamy alluvium from mixed sources, the plant community is dominated by perennial grasses and subshrubs, with lesser amounts of succulents and trees. The predominant grama species are blue, black, sideoats, sprucetop, and hairy grama; other species are wolftail, vine mesquite, cane beardgrass, plains lovegrass, green sprangletop, false mesquite, yerba de pasmo, shrubby buckwheat, Palmer's agave, talinum, bundleflower, rosary bean, sida, evolvulous, bluedicks, and lotus. Plant basal cover ranges from 7 to 20 percent, and cover by plant litter ranges from 20 to 65 percent. Canopy cover ranges from 30 to 75 percent for perennial grasses, 1 to 5 percent for forbs, and 1 to 5 percent for shrubs and succulents. Tree canopy cover ranges from 0 to 5 percent and includes species like Emory oak, Arizona white oak, and alligator and oneseed junipers.

On fan terraces, ridgetops, and piedmonts where soils have formed in mixed, calcareous alluvium, the plant community is dominated by native perennial grasses, shrubs, and succulents. Soaptree yucca is a dominant species and reaches its highest densities on these sites. Other dominant species include beargrass, sotol, sideoats grama, black grama, slim tridens, plains muhly, Hall's panic, New Mexico feathergrass, wooly bunchgrass, blue threeawn, ocotillo, false mesquite, range ratany, feather dalea, bahia, Hopi tea, blue penstemon, croton, scurfpea, and trailing four o'clock. Plant basal cover ranges from 5 to 17 percent, and cover by plant litter ranges from 10 to 40 percent. Canopy cover ranges from 20 to 45 percent for perennial grasses, 1 to 5 percent for forbs, and 2 to 20 percent for shrubs and succulents. Tree canopy cover ranges from 0 to 2 percent and includes species like Emory oak, Arizona white oak, and alligator and oneseed junipers.

On nearly level flood plains, low stream terraces, alluvial fans, and canyon bottoms where soils are formed in recent alluvium from mixed parent materials, the plant community is dominated by trees, with lesser amounts of native perennial grasses, vines, and forbs. The predominant species are Arizona sycamore, Arizona white oak, Emory oak, alligator juniper, Arizona walnut, Arizona ash, mesquite, desert willow, netleaf hackberry, western soapberry, wild grape, sacaton, sideoats grama, green sprangletop, plains bristlegrass, Orcutt's threeawn, buffalo gourd, canaigre, pigweed, morning-glory, ragweed, and camphor weed. Channel areas are active, with natural rates of erosion and sedimentation. Plant basal cover ranges from 4 to 15 percent, and cover by plant litter ranges from 50 to 85 percent. Canopy cover ranges from 20 to 60 percent for grasses, 1 to 10 percent for forbs, and 0 to 5 percent for shrubs. Tree canopy cover ranges from 20 to 50 percent.

On nearly level flood plains, swales, and low stream terraces where soils are formed in recent alluvium from mixed parent materials, the plant community is dominated by native perennial grasses and grass-like plants and forbs. The predominant species are sacaton, sideoats grama, vine mesquite, mat muhly, blue grama, sedges, rushes, yerba mansa, xanthocephalum, annual sunflower, goldeneye, pigweed, and ragweed. Plant basal cover ranges from 20 to 40 percent, and cover by plant litter ranges from 25 to 65 percent. Canopy cover ranges from 30 to 85 percent for grasses, 0 to 10 percent for forbs, and 0 to 2 percent for shrubs. Trees can include species like Arizona white oak, Emory oak, and desert willow, and canopy cover ranges from 0 to 2 percent.

## Objective

1. Every 10 years, treat at least 72,500 acres of grasslands using wildland fire (planned and unplanned ignitions), thinning, and mastication.

### Guidelines

1. Some patches of shrubby species, such as mesquites and yuccas, should be retained during fuel reduction projects on sites where they are appropriate under the desired conditions.
2. Vegetation treatments in semidesert grasslands should provide for maintaining a sustainable population of paniculate agaves.

## Interior Chaparral

### General Description

Interior chaparral occurs throughout the Coronado National Forest as a discontinuous band of vegetation. The majority of this vegetation type exists at mid-elevations (3,000 to 6,000 feet). It is bordered and intermixed with Madrean encinal woodland at the upper elevations and semidesert grassland or Sonoran desert at the lower elevations. Shrub live oak and manzanita shrubs are the most common species within interior chaparral; however, a wide range of other shrubs and trees are also found. Animal species occurring in interior chaparral include American black bear, javelina, cliff chipmunk, white-throated woodrat, scrub jay, rufous-sided towhee, Arizona alligator lizard, and Sonora mountain kingsnake.

Based on projections of future climate change for the region, interior chaparral ecosystems are susceptible to decreases in plant productivity from water limitations and increased heat, increases in insect attacks, colonization by invasive species, longer and more severe fire seasons, and altered frequency, severity, timing, and spatial extent of disturbance events (such as droughts, flash floods, landslides, and windstorms).

### Desired Conditions

#### *Landscape Scale*

The interior chaparral varies from widely scattered pockets within grasslands and woodlands to more extensive areas on steep mountain slopes. Species composition and dominance vary across the broad range of soils and topography, but are dominated by shrubs, including one or some of the following: shrub live oak, birchleaf mountain mahogany, pointleaf manzanita, desert ceanothus, pringle manzanita, and yellow leaf silktassel. The canopy is nearly closed in about 90 percent of the community. Where it is more open, there is a grass and forb component, including native species found in the adjacent grassland and woodland communities. Ground cover consists primarily of shrub litter covering 35 to 45 percent of the soil surface. Natural disturbances provide landscape diversity, wildlife habitat, and maintain a variety of vegetation densities and age classes. Fire occurs at intervals of 20 to 100 years, and is usually stand replacing in nature.

#### *Fine Scale*

Soil condition indicators (35 to 45 percent of total ground cover provided by litter and plant basal area and no signs of compaction or accelerated erosion) signify that soil function is being sustained and soil is functioning properly and normally. The ability of soil to maintain resource values and sustain outputs is high. Vegetation structure in chaparral stands immediately adjacent to high-risk components of the wildland-urban interface are more open with widely scattered groups of shrubs and trees. Typical fire behavior is dramatically reduced as a result of these conditions.

### Objective

1. Treat at least 5,000 acres of interior chaparral every 10 years using wildland fire (planned and unplanned ignitions) and mechanical treatments.

### Guideline

1. Vegetation treatments in interior chaparral should provide for maintaining a sustainable population of paniculate agaves.

## Madrean Encinal Woodland

### General Description

Madrean encinal, or oak, woodland occurs throughout the Coronado National Forest discontinuously distributed in the mountain foothills at elevations ranging from 3,600 to 6,500 feet. These woodlands grade into grasslands at lower elevations and pine-oak woodlands at higher elevations. Emory oak is present throughout the range of Madrean encinal; however, Mexican blue oak and Arizona white oak are the most common oak species. Alligator and single-seed junipers are also common. Madrean encinal woodland plant species (such as manzanita, silktassel, ceanothus, skunkbush sumac, catclaw acacia, mountain mahogany, and rosewood) are common understory shrubs. Warm season perennial bunchgrasses (such as sideoats grama, blue grama, hairy grama, plains lovegrass, deer grass, and longtongue muhly) dominate the understory. Animal species occurring in Madrean encinal woodland include Coues' white-tailed deer, , yellow-nosed cotton rat, lesser long-nosed bat, white-nosed coati, acorn woodpecker, Mexican jay, hepatic tanager, Clark's spiny lizard, Gila spotted whiptail, eastern patch-nosed snake, green ratsnake, rock rattlesnake, Arizona eyed click beetle, and great purple hairstreak. Based on projections of future climate change for the region, Madrean encinal woodland ecosystems are susceptible to decreases in plant productivity from water limitations and increased heat, increases in insect attacks, colonization by invasive species, longer and more severe fire seasons, and altered frequency, severity, timing, and spatial extent of disturbance events (such as droughts, flash floods, landslides, and windstorms).

### Desired Conditions

#### *Landscape Scale*

The Madrean encinal woodland is dominated by an open stand of oaks (5 to 25 percent) with denser stands of oaks on north-facing slopes and in drainages (25 to 50 percent canopy). Species composition of the overstory is dominated by Emory oak, Mexican blue oak, Arizona white oak, gray oak, alligator juniper, and single-seed juniper. Ground cover is dominated by grasses such as threeawns, blue grama, sideoats grama, Rothrock grama, Arizona cottontop, plains lovegrass, curly-mesquite, green sprangletop, deergrass, longtongue muhly, or Texas bluestem. These native, perennial, generally warm-season bunchgrasses in the understory create a wide overlap with the grasslands. Additional ground cover consists primarily of tree and grass litter covering 10 percent of the soil surface in the open stands to 40 percent of the soil surface in the denser stands. Fires occur on average every 3 to 7 years. Fires are of low and mixed severity and occur between April and July, resulting in an overstory canopy of less than 20 percent on about 60 percent of the landscape.

Declining trees provide snags and coarse woody debris. Snags and coarse woody debris are well distributed throughout the landscape. Logs (greater than 6-inch diameter at midpoint and more than 2 feet long) average 3 logs per acre within the forested area of the landscape. Coarse woody debris, including downed logs, ranges from 1 to 5 tons per acre.

### *Mid-Scale*

On steep hillslopes, ridgetops, pediments, and scarps where soils have formed in place on limestone parent materials, the native plant community is dominated by trees and large shrubs with an understory of perennial grasses, subshrubs, and succulents. The dominant species are mountain mahogany, alligator juniper, Emory oak, Arizona white oak, border piñon, cliffrose, manzanita, Mearn's sumac, wavy-leaf oak, desert ceanothus, sideoats and hairy gramas, piñon ricegrass, bullgrass, purple muhly, rough tridens, cliff muhly, New Mexico feathergrass, southwestern stipa, false mesquite, feather dalea, sotol, banana and Schott's yuccas, Parry's agave, bouvardia, hairy goldaster, and ferns. Plant basal cover ranges from 2 to 10 percent, and cover by plant litter ranges from 20 to 50 percent. Canopy cover ranges from 5 to 40 percent for perennial grasses, 1 to 5 percent for forbs, and 1 to 10 percent for shrubs and succulents. Tree and large shrub canopy cover ranges from 10 to 40 percent and includes species like mountain mahogany, border piñon, and alligator juniper. Other species occur in lesser amounts, such as Emory oak, Arizona white oak, oneseed, Utah and redberry junipers, and Arizona rosewood. Mountain mahogany forms treelike woodlands on southern exposures with more oak species on cooler exposures. Mixed piñon-juniper woodlands dominate on pediments and steep north exposures at higher elevations. Small canyon inclusions in this bedrock unit have sufficient extra moisture for riparian tree, shrub, grass, and forb species to persist. These areas are the conduit that provides for the safe capture and release of sediment and water.

On fan terraces, plains, and moderate to steep slopes where soils have formed in loamy alluvium from mixed sources; soils are old, loamy to clayey, deep, and slightly alkaline to slightly acid in reaction. The potential native plant community here is dominated by trees, with lesser amounts of perennial grasses, forbs, shrubs, and succulents. The predominant species are Emory and Arizona white oaks, manzanita, beargrass, Schott's yucca, blue, sideoats, and hairy gramas, Orcutt's threeawn, bullgrass, Texas bluestem, cane beardgrass, plains lovegrass, green sprangletop, crinkleawn, piñon ricegrass, prairie junegrass, bottlebrush squirreltail, false mesquite, yerba de pasmo, shrubby buckwheat, Palmer's agave, bouvardia, psoralea, rosary bean, trailing fleabane, and lotus. Plant basal cover ranges from 2 to 10 percent and cover by plant litter ranges from 20 to 75 percent. Canopy cover ranges from 5 to 50 percent for perennial grasses, 1 to 5 percent for forbs, and 0 to 5 percent for shrubs and succulents. Tree canopy cover ranges from 10 to 45 percent, consisting primarily of Emory oak, Arizona white oak, and alligator juniper.

On nearly level flood plains, low stream terraces, alluvial fans, and canyon bottoms where soils are formed in recent alluvium from mixed parent materials, the plant community is dominated by trees, with lesser amounts of perennial grasses, vines, shrubs, and forbs. The predominant tree species are Arizona sycamore, Arizona cypress, Arizona white oak, Emory oak, grey oak, alligator juniper, Arizona walnut, Arizona ash, madrone, bigtooth maple, alder, ponderosa pine, Apache pine, Chihuahuan pine, and Douglas-fir. Understory species include wild grape, Virginia creeper, thimbleberry, redosier dogwood, Godding's yew-leaf, coyote and arroyo willows, poison ivy, Arizona wildrye, deergrass, sideoats grama, bulb panic, green sprangletop, Orcutt's threeawn, sedges, rushes and bullrushes, wood sorrel, geranium, tickclover, goldenrod, and meadow rue. Channel areas are active with both erosion and sedimentation. Streambanks are well protected by dense stands of trees, shrubs, and vines. In places, these areas have perennial streamflow. In other areas, flows are intermittent, but all areas receive extra water in the form of runoff from adjacent

watersheds and have streamflow in the fall and spring for prolonged periods. Plant basal cover ranges from 4 to 10 percent, and cover by plant litter ranges from 30 to 65 percent. Canopy cover ranges from 5 to 40 percent for grasses, 1 to 10 percent for forbs, and 0 to 5 percent for shrubs. Tree canopy cover ranges from 30 to 70 percent. Tree canopy in dry or intermittent stretches is dominated by sycamore, pine, cypress, juniper, and oak species. Tree canopy in perennial streamflow areas is dominated by sycamore, walnut, ash, willow, maple, alder, and dogwood.

On gently rolling pediments to steep hillslopes and ridgetops where soils have formed in place on igneous and metamorphic parent materials like granite, rhyolite, andesite, gneiss, schist, and quartzite, the plant community is dominated by trees, including Emory oak and Arizona white oak. Other trees include grey oak, border piñon, and oneseed and alligator junipers, with an understory of perennial grasses and forbs, subshrubs, shrubs, and succulents. The primary understory species include sideoats grama, hairy grama, cane beardgrass, plains lovegrass, bullgrass, Texas bluestem, crinkleawn, wooly bunchgrass, Orcutt's threeawn, piñon ricegrass, prairie junegrass, beargrass, Schott's yucca, mimosa species, manzanita, Toumey oak, turbinella oak, silktassel, California bricklebush, coralbean, skunkbush, shrubby buckwheat, Palmer's agave, trailing fleabane, bouvardia, blue curls, and ferns. Plant basal cover ranges from 5 to 10 percent, and cover by plant litter ranges from 35 to 70 percent. Canopy cover ranges from 5 to 45 percent for perennial grasses, 1 to 10 percent for forbs, and 1 to 5 percent for shrubs and succulents. Tree canopy cover ranges from 10 to 50 percent and consists primarily of Emory and Arizona white oaks. Understory species and density are unaffected by tree canopies from 10 to 35 percent, but are limited as tree canopy cover approaches 50 percent. Small canyon inclusions have sufficient extra moisture for riparian tree, shrub, grass, and forb species to persist there. These areas are the conduit to provide the safe capture and release of sediment and water in these mountain systems.

### *Fine Scale*

Within patches, single large trees or small groups of trees are widely spaced between large expanses of grasses and shrubs. Total ground cover by litter and plant basal area is 15 to 65 percent, and the lack of signs of compaction or accelerated erosion indicates that the soil is functioning properly. The ability of soil to maintain resource values and sustain outputs is high.

Some large-diameter trees, snags, and shrubs are retained following fuel treatments, fuelwood gathering, and prescribed fire.

## Objective

1. Treat at least 367,000 acres of Madrean encinal woodlands using wildland fire (planned and unplanned ignitions) and mechanical treatments (thinning and mastication) every 10 years.

## Guidelines

1. Fuel reduction and habitat restoration projects should leave clusters of live trees, snags, and shrubs to benefit species that require these structures for breeding, feeding, shelter, and other habitat needs.
2. Vegetation treatments in Madrean encinal woodland should provide for maintaining a sustainable population of paniculate agaves.

## Madrean Pine-Oak Woodland

### General Description

Madrean pine-oak woodlands are bounded by Madrean encinal woodlands, plains, and savannah grasslands at the lowest elevations. The upper elevations are bounded by ponderosa pine-evergreen shrub and dry mixed-conifer communities. Elevations range from 6,000 feet to over 8,000 feet. Annual precipitation averages from 20 to over 30 inches. Some plant species occurring in woodland communities include sideoats grama, blue grama, hairy grama, plains lovegrass, bullgrass, deergrass, longtongue muhly, mountain muhly, Texas bluestem, crinkleawn, prairie junegrass, piñon ricegrass, bouvardia, silktassel, manzanita, Fendler's buckbrush, Parry's and Palmer's agave, beargrass, sotol, mountain mahogany, pine, fir, oak, piñon, and juniper species. Ground cover consists primarily of organic layers (duff) of pine needles and/or oak leaves and twigs. Gravel, cobble, and rock cover ranges from 20 to 40 percent. Bedrock outcrop ranges from 5 to 40 percent of the surface. Disturbances in the Madrean pine-oak woodland community include fire, insects, and diseases. Fires are typically of low and mixed severity causing frequent, larger scale disturbances. Insects are generally small-scale disturbance agents, but have the potential to cause large-scale disturbances. Dwarf mistletoes, parasitic plants found on several coniferous species, are chronic disturbance agents. Animal species occurring in Madrean pine-oak woodland communities include Coues' white-tailed deer, Arizona gray squirrel, Chiricahua squirrel, common hog-nosed skunk, Gould's wild turkey, painted redstart, acorn woodpecker, red-faced warbler, whiskered screech-owl, mountain skink, striped plateau lizard, ridge-nosed rattlesnake, Sonoran mountain kingsnake, and Huachuca giant skipper. The acorn woodpecker is a management indicator species for this vegetation community. Based on projections of future climate change for the region, Madrean pine-oak woodland ecosystems are susceptible to decreases in plant productivity from water limitations and increased heat, increases in insect attacks, colonization by invasive species, longer and more severe fire seasons, and altered frequency, severity, timing, and spatial extent of disturbance events (such as droughts, flash floods, landslides, and windstorms).

### Desired Conditions

#### *Landscape Scale*

In Madrean pine-oak woodland communities, the predominant species are native trees. There is moderate to dense vegetation cover that includes mid-sized and short perennial grasses and forbs, subshrubs, shrubs, and trees. The Madrean pine-oak woodland varies from generally open (with large trees providing 10 percent canopy with a grass understory) to groups of 50 percent canopy. Approximately 30 percent of the area is in the open condition; the remainder is closed. The predominant tree species are Arizona white oak, Emory oak, silverleaf oak, Apache pine, and Chihuahua pine. The oaks are generally tree form and do not dominate the community. Other commonly occurring trees include alligator juniper, Arizona madrone, Arizona cypress, and border piñon. A shrub layer is present and often contains species such as beargrass, littleleaf sumac, evergreen sumac, yellow leaf silktassel, birchleaf buckthorn, and ceanothus species. Grasses are common, including long tongue muhly and bullgrass. Ground cover is sufficient to carry fire through the landscape. Fire is of mixed severity and occurs at variable intervals, dependent on conditions within the community and within adjacent vegetation types. Plant basal area ranges from 0 to 10 percent of the soil surface. Plant litter occupies 20 to 90 percent of the soil surface. Litter and plant cover values represent the range from after disturbance events (like fire or drought) to the time at which site equilibrium is reached. There are no signs of compaction or accelerated erosion.

Declining trees provide snags and coarse woody debris. Snags and coarse woody debris are well distributed throughout the landscape. Downed logs (greater than 10-inches diameter at midpoint and more than 8 feet long) average 3 logs per acre within the forested area of the landscape. Coarse woody debris, including downed logs, ranges from 3 to 10 tons per acre.

The ability of soil to maintain resource values and sustain outputs is high. Native vegetation structure and composition provide habitat for animal species that live in this vegetation community. Traditional food and material plants thrive here, including pine, fir, oak, walnut, piñon, juniper, manzanita, skunkbush, agave, yucca, beargrass, monarda (oregano), and terragon.

### *Mid-Scale*

At elevations between 6,000 and 7,400 feet, the plant community is dominated by trees, primarily silverleaf oak and lesser amounts of alligator juniper and Arizona white oak. Other trees include Emory oak, grey oak, border piñon, and Arizona, Apache and Chihuahuan pines, with a sparse understory of perennial grasses, forbs, and shrubs. The main large shrubs include turbinella oak, netleaf oak, Toumey oak, manzanita, silktassel, narrowleaf hoptree, and mountain mahogany. Perennial forbs and grasses occur in minor amounts and include bullgrass, longtongue muhly, sideoats grama, trailing fleabane, bouvardia, verbena, and ferns. Plant basal cover ranges from 3 to 5 percent. Cover by plant litter (primarily oak leaves and twigs) ranges from 55 to 90 percent. Canopy cover ranges from 0 to 5 percent for perennial grasses, 0 to 5 percent for forbs, and 1 to 15 percent for large shrubs. Tree canopy cover ranges from 50 to 70 percent, consisting primarily of silverleaf oak. The life form of silverleaf oak is virtually all multistem, resulting from repeated fires and coppice sprouting. Pine species come into this plant community on cooler northern aspects in long fire-free intervals. At elevations between 6,500 and 8,900 feet, the plant community is dominated by Arizona pine, Apache pine, Chihuahuan pine, Arizona white oak, and Gambel oak. Perennial grasses in the understory plant community include longtongue muhly, mountain muhly, bullgrass, screwleaf muhly, pine dropseed, Arizona fescue, piñon ricegrass, nodding brome, muttongrass, prairie junegrass, and Pringle needlegrass. Perennial forbs include sneezeweed, columbine, geranium, wood sorrel, verbena, meadow rue, goosegrass, gentian, mule ears, and groundsel species. Common shrubs include netleaf oak, Fendler’s buckbrush, Palmer’s oak, New Mexico locust, turbinella oak, creeping mahonia, mountain snowberry, flame sumac, wild rose, and wax currant. Plant basal cover ranges from 5 to 10 percent. Cover by plant litter ranges from 40 to 80 percent and includes both grass litter and a duff of pine needles. Canopy cover ranges from 5 to 25 percent for perennial grasses, 0 to 5 percent for forbs, and 0 to 10 percent for large shrubs. Tree canopy cover ranges from 20 to 60 percent, consisting primarily of pines.

### *Fine Scale*

Patches of single, large trees or small groups of trees are widely spaced between large expanses of grasses and shrubs. Total ground cover by litter and plant basal area ranges from 20 to 100 percent, and there are no signs of compaction or accelerated erosion. The soil is functioning properly, and the ability of soil to maintain resource values and sustain outputs is high.

## Objective

1. Treat at least 25,000 acres of Madrean pine-oak woodlands using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication every10 years.

### Guidelines

1. Vegetation treatments in Madrean pine-oak woodlands should provide for maintaining a sustainable population of paniculate agaves.
2. Clusters of trees, shrubs, and snags should be maintained in treatment areas to benefit species that require these structures for breeding, feeding, shelter, and other needs.
3. Slash piles should be burned in locations and at times that will minimize scorching of adjacent trees and shrubs.
4. An uneven-aged forest management approach should be emphasized; however, both even-aged and uneven-aged systems may be used where appropriate to provide variation in existing stand structure and species diversity.
5. Surveys for reforestation needs should be completed within 2 years following a wildfire or other natural disturbance greater than 2,000 acres.
6. Natural regeneration of disturbed areas should be allowed where feasible unless the following circumstances exist: (1) endangered species habitat needs to be restored, (2) the time period of recovery is deemed excessive due to the large size of deforested area and/or lack of nearby seed sources, or (3) there is concern for loss of site capacity from soils loss or extreme competition with early-seral species.

### Management Approaches

1. Maintaining a seed inventory for each major conifer species based on a seed collection plan approved by the regional geneticist.
2. Developing an overall framework for economic analysis to determine the types of reforestation investments (treatments) needed, determining the least costly manner of executing a treatment, and determining priorities when funding prevents treatment of all acres.
3. Striving to complete identified reforestation projects within 10 years.

## Ponderosa Pine-Evergreen Shrub

### General Description

The ponderosa pine-evergreen shrub ecosystem generally occurs as a discontinuous band of vegetation at elevations ranging from approximately 5,000 to 10,000 feet. This community is dominated by ponderosa and Arizona pines and is interspersed in the transition between the Madrean pine-oak woodland and mixed-conifer vegetation types. Ponderosa pine-evergreen shrub has two subclasses: one with a more continuous layer of perennial grasses and a relatively minor shrub component, and one with an understory of primarily evergreen shrubs (including manzanita, turbinella oak, sumac species, and mountain mahogany species). Disturbances in the ponderosa pine-evergreen shrub community include fire, insects, and diseases. Fires are typically of low and mixed severity causing frequent, larger scale disturbances. Insects are generally small-scale disturbance agents, but have the potential to cause large-scale disturbances. Dwarf mistletoes, parasitic plants found on several coniferous species, are chronic disturbance agents. Animal species occurring in this community include North American porcupine, Abert's squirrel (nonnative), striped skunk, white-breasted nuthatch, Gould's wild turkey, Grace's warbler,

flammulated owl, Yarrow's spiny lizard, Arizona black rattlesnake, twin-spotted rattlesnake, and Chiricahua white butterfly. Under changing climate conditions, ponderosa pine-evergreen shrub ecosystems are susceptible to decreases in plant productivity from water limitations and increased heat, increases in insect attacks, colonization by invasive species, longer and more severe fire seasons, and altered frequency, severity, timing, and spatial extent of disturbance events (such as droughts, flash floods, landslides, and windstorms). High-risk occurrences could include uncharacteristically intense wildfire, increased rate of insect or disease attack due to warming temperatures, and increasing challenges to regeneration of ponderosa pine, especially on warmer, drier areas such as south-facing slopes.

## Desired Conditions

### *Landscape Scale*

At the landscape scale, the ponderosa pine-evergreen shrub is composed of trees from structural stages ranging from young to old. Forest appearance is variable but generally uneven-aged and open; areas of even-aged structure are present. The forest arrangement is in small clumps and groups of trees interspersed within variably sized openings of moderate to high density shrubs and limited grass cover. Openings typically range from 10 percent in more productive sites to 70 percent in less productive sites. Size, shape, number of trees per group, and number of groups per area are variable across the landscape. All structural stages of oak are present, with old trees occurring as dominant individuals or in small groups. Denser tree conditions exist in some locations, such as north-facing slopes and canyon bottoms.

Old growth occurs throughout the landscape, generally in small areas as individual old-growth components, or as clumps of old growth. Old-growth components include old trees, dead trees (snags), downed wood (coarse woody debris), and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).

The ponderosa pine-evergreen shrub is composed predominantly of vigorous trees and shrubs, but declining trees and shrubs are a component. Declining trees provide snags and coarse woody debris. Snags and coarse woody debris are well distributed throughout the landscape. Ponderosa pine snags are typically 18 inches or greater diameter at breast height and average 1 to 2 snags per acre; large oak snags (greater than 10 inches diameter) are a well-distributed component. Downed logs (greater than 12-inches diameter at midpoint and more than 8 feet long) average 3 logs per acre within the forested area of the landscape. Coarse woody debris, including downed logs, ranges from 3 to 10 tons per acre.

The composition, structure, and function of vegetation conditions are resilient to the frequency, extent, and severity of disturbances and climate variability. The landscape is a functioning ecosystem that contains all its components, processes, and conditions that result from natural disturbances (such as insects, diseases, fire, and wind), including old growth. Dwarf mistletoe occurs in less than 15 percent of trees in uneven-aged forest structures and less than 25 percent in even-aged forest structures. Limited grasses, forbs, and a moderate density of shrubs, needlecast, and small trees maintain the natural fire regime.

Organic ground cover and herbaceous vegetation provide protection of soil, moisture infiltration, and contribute to plant and animal diversity and ecosystem function. Low- to mixed-severity fires (fire regimes I and III) are characteristic in this type. Natural and human-caused disturbances are sufficient to maintain desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling.

### *Mid-Scale*

At the mid-scale, the ponderosa pine-evergreen shrub community is characterized by variation in the size and number of tree groups, depending on elevation, soil type, aspect, and site productivity. The more biologically productive sites contain more trees per group and more groups per area. Openings typically range from 10 percent in the more productive sites to 70 percent in the less productive sites. Tree density within forested areas generally ranges from 20 to 80 square feet basal area per acre.

The mosaic of tree groups comprises a mix of even-aged and uneven-aged patches with all age classes and structural stages present. The mix of natural disturbances sustains the overall age and structural distribution.

Fires are of low to mixed severity, burning on the forest floor as well as in the overstory. Crown fires occur in small patches.

Forest structure in the wildland-urban interface may have smaller, more widely spaced groups of trees than in the areas that are not wildland-urban interface. There are no stand-replacement fires in the wildland-urban interface. As ignitions occur, flame lengths will typically be less than 4 feet. Forest stands are able to withstand and recover from periodic wildland fires.

Forest conditions in goshawk post-fledging family areas are similar to general forest conditions except these forests contain 10 to 20 percent higher basal area in the mid-age to old tree groups than goshawk foraging areas and the general forest. Goshawk nest areas have forest conditions that are multi-aged but are dominated by large trees with relatively denser canopies than other areas in the ponderosa pine-evergreen shrub type.

### *Fine Scale*

Trees typically occur individually or in small groups in which they are variably spaced, with some tight clumps. Crowns of trees within mid- to old-age groups are interlocking or nearly interlocking. Openings in between tree groups are variably shaped and comprised of shrubs, forbs, and grasses. Some openings may contain a high density of shrubs and/or individual trees, including large oaks. Trees within groups are of similar or variable ages and may contain species other than ponderosa pine. The size of tree groups is typically less than 0.5 acre. Occasionally ponderosa pine occurs with a bunchgrass understory instead of a shrub-dominated understory.

## Objective

1. Every 10 years, treat at least 12,500 acres of ponderosa pine-evergreen shrub using wildland fire (planned and unplanned ignitions) and mechanical treatments (prescribed cutting and mastication).

## Guidelines

1. .Vegetation treatments reflect the characteristic structure stage proportions in order to provide continuous representation of old growth and all structure stages on the landscape.
2. Slash piles from harvest activities should be burned in locations and at times that will minimize scorching of adjacent trees and shrubs.
3. Fuel reduction or fuelwood gathering projects should retain some large-diameter trees, snags and shrubs, and these should be protected well enough from scorching to survive subsequent burn treatments.

4. Surveys for reforestation needs should be completed within 2 years following a wildfire or other natural disturbance greater than 2,000 acres.
5. Natural regeneration of disturbed areas should be allowed where feasible unless the following circumstances exist: (1) endangered species habitat needs to be restored, (2) the time period of recovery is deemed excessive due to the large size of deforested area and/or lack of nearby seed sources, or (3) there is concern for loss of site capacity from soils loss or extreme competition with early-seral species.

### Management Approaches

1. Maintaining a seed inventory for each major conifer species based on a seed collection plan approved by the regional geneticist.
2. Developing an overall framework for economic analysis to determine the types of reforestation investments (treatments) needed, determining the least costly manner of executing a treatment, and determining priorities when funding prevents treatment of all acres.
3. Striving to complete identified reforestation needs within 10 years.

## Mixed-Conifer Forest

### General Description

The mixed-conifer forest type is an upper elevation coniferous forest composed of multiple species. Douglas-fir is common throughout this type. Composed of both wet and dry mixed-conifer forest types, this vegetation community generally occurs at elevations ranging from approximately 5,500 to 10,000 feet. The mixed-conifer vegetation community is transitional, merging with the ponderosa pine-evergreen shrub community at lower elevations and with spruce-fir forest at higher elevations in the Pinaleño Mountains. As mixed conifer transitions from dry to wet conditions along elevational gradients and varies by topographic aspect, ponderosa pine and Gambel oak become less abundant while aspen, white fir, and southwestern white pine become more abundant. The mixed-conifer forest typically occurs with understories of grasses, forbs, shrubs, and young trees. On the Coronado National Forest, the transition between dry and wet mixed-conifer forests is gradual and difficult to define both on the ground and through aerial mapping techniques. The distinction between wet and dry mixed-conifer is typically determined through both a shift in dominant seral species and disturbance regime. Disturbances in the mixed-conifer community include fire, insects, diseases, and wind. On drier sites, fire is the primary disturbance agent, which historically occurred frequently. Fire is generally not limited by lack of fuel connectivity or high fuel moistures. Insects are generally small-scale disturbance agents, but have the potential to cause large-scale disturbances. Dwarf mistletoes, parasitic plants found on several coniferous species, are chronic disturbance agents.

Conversely, on wetter sites, fire is more limited by higher fuel moistures, occurring as larger scale, less frequent disturbances usually during periods of long-term drought. Historically on the Coronado National Forest, insects, diseases, and wind have caused frequent, small-scale disturbances. However, elsewhere in the West, insects cause large-scale disturbances in wet mixed-conifer. Animal species occurring in the mixed-conifer vegetation community include Mount Graham red squirrel (Pinaleño Mountains only), American black bear, Allen’s big-eared bat, long-legged myotis, northern goshawk, Mexican spotted owl, brown creeper, broad-tailed hummingbird, Madrean alligator lizard, greater short-horned lizard, wandering gartersnake, twin-

spotted rattlesnake, pine satyr, and Weidemeyer's admiral butterfly. The Mexican spotted owl is a management indicator species for both the wet and dry mixed-conifer communities. Based on projections of future climate change for the region, mixed-conifer forest ecosystems are susceptible to decreases in plant productivity from water limitations and increased heat, increases in frequency, intensity and severity of insect attacks, colonization by invasive species, longer and more severe fire seasons, and altered frequency, severity, timing, and spatial extent of disturbance events (such as droughts, flash floods, landslides, windstorms, and ice storms). Extended drought from delayed monsoons or earlier onset of spring conditions could lead to increased tree mortality, resulting in increasing risk of intense wildfire.

## Dry Mixed-Conifer Forest

### General Description

This forest type is transitional with increasing elevation between ponderosa pine-evergreen shrub and wet mixed-conifer forest types and generally occurs at elevations ranging from approximately 5,500 to 9,500 feet. The dry mixed-conifer forest characterizes the majority of the greater mixed-conifer community, representing approximately 88 percent of the Coronado National Forest's mixed-conifer forest. Dry mixed-conifer forests are dominated by tree species such as ponderosa pine, southwestern white pine, Douglas-fir, and Gambel oak, with a lesser and localized presence of aspen, white fir, corkbark fir, and Engelmann spruce. This forest type typically occurs with understories of grasses, forbs, shrubs, and young trees. Fires occur frequently and are generally not limited by lack of fuel connectivity or high fuel moistures. Insects are generally small-scale disturbance agents, but have the potential to cause large-scale disturbances. Dwarf mistletoes, parasitic plants found on several coniferous species, are chronic disturbance agents.

### Desired Conditions: Dry Mixed-Conifer

*Landscape Scale*

At the landscape scale, the dry mixed-conifer type is a mosaic of forest conditions composed of structural stages ranging from young to old trees. Forest appearance is variable, but generally uneven-aged and open; occasional patches of even-aged structure are present. The forest arrangement is in small clumps and groups of trees interspersed within variably sized openings of grass, forb, and shrub vegetation associations similar to historic patterns. Openings typically range from 10 percent in more productive sites to 50 percent in less productive sites. Size, shape, number of trees per group, and number of groups per area are variable across the landscape. Where they naturally occur, groups or patches of aspen and all structural stages of oak are present. Denser tree conditions exist in some locations, such as north-facing slopes and canyon bottoms.

Old growth occurs throughout the landscape, generally in small areas as individual old-growth components, or as clumps of old growth. Old-growth components include old trees, dead trees (snags), downed wood (coarse woody debris), and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).

The dry mixed-conifer type is composed predominantly of vigorous trees, but declining trees provide snags and coarse woody debris. Snags and coarse woody debris are well distributed throughout the landscape. Snags are typically 18 inches or greater diameter and average 3 per acre. Downed logs (those greater than 12 inches in diameter at midpoint and more than 8 feet

long) average 3 per acre within the forested area of the landscape. Coarse woody debris, including downed logs, ranges from 5 to 15 tons per acre.

The composition, structure, and function of vegetative conditions are resilient to the frequency, extent, severity of disturbances, and to climate variability. The landscape is a functioning ecosystem that contains all its components, processes, and conditions that result from endemic levels of disturbances (such as insects, diseases, fire, and wind), including snags, downed logs, and old trees. Grasses, forbs, shrubs, needle cast (fine fuels), and small trees maintain the natural fire regime. Organic ground cover and herbaceous vegetation provide protection of soil, moisture infiltration, and contribute to plant and animal diversity and to ecosystem function. Frequent, low-severity fires (fire regime I) are characteristic in this type, including throughout goshawk home ranges. Natural and human-caused disturbances are sufficient to maintain desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling.

### *Mid-Scale*

At the mid-scale, the dry mixed-conifer type is characterized by variation in the size and number of tree groups, depending on elevation, soil type, aspect, and site productivity. The more biologically productive sites contain more trees per group and more groups per area. Openings typically range from 10 percent in more productive sites to 50 percent in less productive sites. Tree density within forested areas generally ranges from 30 to 100 square feet basal area per acre.

The mosaic of tree groups generally consists of an uneven-aged forest with all age classes and structural stages. Occasionally, small patches (generally less than 50 acres) of even-aged forest structure are present. Disturbances sustain the overall age and structural distribution.

Fires burn primarily on the forest floor and do not spread between tree groups as crown fire.

Forest structure in the wildland-urban interface has smaller and more widely spaced groups of trees than in the areas that are not wildland-urban interface.

Forest conditions in goshawk post-fledging family areas are similar to general forest conditions except these forests contain 10 to 20 percent higher basal area in mid-aged to old tree groups than in goshawk foraging areas and in the general forest. Goshawk nest areas have forest conditions that are multi-aged but are dominated by large trees with relatively denser canopies than other areas in the dry mixed-conifer type.

### *Fine Scale*

Trees typically occur in irregularly shaped groups and are variably spaced with some tight clumps. Crowns of trees within the mid-aged to old groups are interlocking or nearly interlocking. Openings surrounding tree groups are variably shaped and composed of a grass, forb, and shrub mix. Some openings contain individual trees or snags. Trees within groups are of similar or variable ages and represent one or more species. Tree groups typically are less than 1 acre in size. Groups at the mid-age to old stages consist of 2 to approximately 50 trees per group.

## Objective

1. Treat at least 13,800 acres of dry mixed conifer using wildland fire (planned and unplanned ignitions) and prescribed cutting every 10 years.

## Guidelines

1. Vegetation treatments reflect the characteristic structure stage proportions in order to provide continuous representation of old growth and all structure stages on the landscape.

2. Slash piles should be burned in locations and at times that will minimize scorching of adjacent trees and shrubs.
3. Fuel reduction or firewood gathering projects should retain some large diameter trees, snags and shrubs, and these should be protected well enough from scorching to survive subsequent burn treatments.
4. Surveys for reforestation needs should be completed within 2 years following a wildfire or other natural disturbance greater than 2,000 acres.
5. Natural regeneration of disturbed areas should be allowed where feasible unless the following circumstances exist: (1) endangered species habitat needs to be restored, (2) the time period of recovery is deemed excessive due to the large size of deforested area and/or lack or nearby seed sources, or (3) there is concern for loss of site capacity from soils loss or extreme competition with early-seral species.

### Management Approaches

1. Maintaining a seed inventory for each major conifer species based on a seed collection plan approved by the regional geneticist.
2. Developing an overall framework for economic analysis to determine the types of reforestation investments (treatments) needed, determining the least costly manner of executing a treatment, and determining priorities when funding prevents treatment of all acres.
3. Striving to complete identified reforestation needs within 10 years.

## Wet Mixed-Conifer Forest

### General Description

The wet mixed-conifer forest type generally occurs at elevations ranging from approximately 5,500 to 10,000 feet, representing only 12 percent of the greater mixed-conifer vegetation community. Tree species composition varies, depending on seral stage, elevation, and moisture availability. This forest type can be composed of early-seral species such as aspen, Douglas-fir, New Mexico locust, southwestern white pine, and Rocky Mountain maple, and late-seral species such as white fir and Engelmann spruce. Ponderosa pine may be present in minor proportions, decreasing with increasing elevation gradients. This forest type transitions with the spruce-fir forest type at its upper elevation range (Pinaleño Mountains only), with ever increasing amounts of Engelmann spruce and corkbark fir in the later seral stages. Disturbances in this type typically occur at two spatial and temporal scales: large scale, infrequent disturbances and small scale, frequent disturbances. Fire in this type is generally limited more by higher fuel moisture than by lack of woody fuels, occurring as larger scale, less frequent disturbances usually during periods of long-term drought. Historically on the Coronado National Forest, insects, diseases, and wind cause small scale, frequent disturbances; however, elsewhere in the West, insects cause large-scale disturbances in this vegetation community. Wet mixed conifer has an understory of a wide variety of shrubs, grasses, forbs, and young trees depending on soil type, aspect, elevation, disturbance, and other factors.

## Desired Conditions: Wet Mixed-Conifer

### *Landscape Scale*

The wet mixed-conifer forest type is a mosaic of structural and seral stages ranging from young to old trees. The landscape arrangement is an assemblage of variably sized and aged groups and patches of trees and other vegetation associations similar to historic patterns. Tree groups and patches are composed of variable species composition, depending on forest seral stages. An approximate balance of seral stages is present across the landscape; each seral stage is characterized by distinct dominant species composition and biophysical conditions. Canopies are generally more closed than in dry mixed conifer. An understory consisting of native grass, forbs, and/or shrubs is present. Aspen is occasionally present in small patches.

Old growth generally occurs over large areas as stands or forests where old growth is concentrated. Old growth includes old trees, dead trees (snags), downed wood (coarse woody debris), and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).

The wet mixed-conifer vegetation community is composed predominantly of vigorous trees, but older declining trees provide snags and coarse woody debris. Snags and coarse woody debris are well distributed throughout the landscape. Number of snags and the amount of downed logs (greater than 12 inches diameter at mid-point, greater than 8 feet long) and coarse woody debris (greater than 3 inches diameter) vary by seral stage.

The composition, structure, and function of vegetation conditions are resilient to the frequency, extent, and severity of disturbances and climate variability. The forest landscape is a functioning ecosystem that contains all its components, processes, and conditions that result from endemic levels of disturbances (such as insects, diseases, wind, and fire), including snags, downed logs, and old trees. Organic ground cover and herbaceous vegetation provide protection of soil, moisture infiltration, and contribute to plant and animal diversity and to ecosystem function. Mixed-severity fire (fire regime III) is characteristic. High-severity fires (fire regimes IV and V) rarely occur. Natural and human-caused disturbances are sufficient to maintain desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling.

### *Mid-Scale*

At the mid-scale, the size and number of groups and patches vary, depending on disturbance, elevation, soil type, aspect, and site productivity. Patch sizes vary but are frequently in the hundreds of acres and occasionally in the thousands of acres. Groups and patches of tens of acres or less are relatively common. A mosaic of groups and patches of trees, primarily even-aged and variable in size, species composition, and age, is present. Grass, forb, and shrub openings created by disturbance may cover 10 to 100 percent of the mid-scale area depending on the disturbances and the time since disturbance. Aspen is occasionally present in large patches.

Density ranges from 20 to 180 square feet basal area per acre, depending upon time since disturbance and seral stages of groups and patches. Snags 18 inches diameter or greater range from 1 to 5 snags per acre, with the lower range of snags of this size associated with early-seral stages and the upper range associated with late-seral stages. Snag density in general (greater than 8 inches diameter at breast height) averages 20 per acre. Coarse woody debris, including downed logs, varies by seral stage, with averages ranging from 5 to 20 tons per acre for early-seral stages, 20 to 40 tons per acre for mid-seral stages, and 35 tons per acre or greater for late-seral stages.

Mixed-severity (fire regime III) and high-severity (fire regime IV) fires and other disturbances maintain desired overall tree density, structure, species composition, coarse woody debris, and

nutrient cycling. High-severity fires generally do not exceed 1,000-acre patches of mortality. Other smaller disturbances occur more frequently.

Forests in the wildland-urban interface are dominated by early-seral, fire-adapted species growing in an overall more open condition than the remainder of the national forest. These conditions result in fires that burn primarily on the forest floor and rarely spread as crown fire.

Forest conditions in goshawk post-fledging family areas are similar to general forest conditions except these forests contain 10 to 20 percent higher tree density (basal area) than goshawk foraging areas and the general forest. Nest areas have forest conditions that are multi-aged but are dominated by large trees with relatively denser canopies than other areas in the wet mixed-conifer type.

*Fine Scale*

In mid-aged and older forests, trees are typically variably spaced with crowns interlocking (grouped and clumped trees) or nearly interlocking. Trees within groups can be of similar or variable species and ages. Small openings (gaps) are present as a result of disturbances.

### Objective

1. Treat at least 2,400 acres of wet mixed conifer using wildland fire (planned and unplanned ignitions) and prescribed cutting every 10 years.

### Guidelines

1. Vegetation treatments reflect the characteristic structure stage proportions in order to provide continuous representation of old growth and all structure stages on the landscape.
2. Slash piles should be burned in locations and at times that will minimize scorching of adjacent trees and shrubs.
3. Vegetation treatments should be designed to create stand conditions that enhance cone production of white fir, corkbark fir, Engelmann spruce, and Douglas-fir in order to provide a reliable Mount Graham red squirrel food source.
4. Fuel reduction or fuelwood gathering projects should retain some large diameter trees, snags and shrubs, and these should be protected well enough from scorching to survive subsequent burn treatments.
5. Surveys for reforestation needs should be completed within 2 years following a wildfire or other natural disturbance greater than 1,000 acres.
6. Natural regeneration of disturbed areas should be allowed where feasible unless the following circumstances exist: (1) endangered species habitat needs to be restored, (2) the time period of recovery is deemed excessive due to the large size of deforested area and/or lack or nearby seed sources, or (3) there is concern for loss of site capacity from soils loss or extreme competition with early-seral species.

## Management Approaches

1. Using chemical pheromones if necessary to control pests and disease before they affect forests at the stand level.
2. Striving to complete identified reforestation needs within 10 years.

# Spruce-Fir

## General Description

The spruce-fir forest type occurs only in the Pinaleño Mountains, though spruce and fir species are present at multiple scales elsewhere on the Coronado. The spruce-fir community occupies the coldest, wettest, and highest elevation sites on the Coronado, occurring at elevations ranging from approximately 8,500 to 10,720 feet. This community can be subdivided into lower elevation and upper elevation spruce-fir, each with differing disturbance regimes and subdominant species composition. At the lower elevations, spruce-fir resembles the wet mixed-conifer community except with a different composition of tree species, due to colder and wetter conditions, and it is a transition zone between wet mixed conifer and the upper elevation spruce-fir community. At these elevations, the spruce-fir community is discontinuous and often occurs as elongated stands in drainages. The majority of the spruce-fir vegetation community occupies upper elevation sites ranging from 10,000 to 10,720 feet.

Spruce-fir is often dominated by Engelmann spruce but contains other species depending on elevation. In lower elevations, the common tree species are aspen, Douglas-fir, white fir, and southwestern white pine. The late-seral forest is dominated by Engelmann spruce. Subdominant species may include corkbark (subalpine) fir. In the upper elevation range of spruce-fir, the dominant tree species are Engelmann spruce and corkbark fir. Patches of aspen are occasionally present but are usually absent. Douglas-fir and southwestern white pine are accidental. Understory plant species commonly include currants, maples, honeysuckle, whortleberry, alpine clover, and sedges. Animal species occurring in spruce-fir include Mount Graham red squirrel, long-tailed vole, cordilleran flycatcher, warbling vireo, Clark’s nutcracker, Steller’s jay, Yarrow’s spiny lizard, and twin-spotted rattlesnake.

On the Coronado National Forest, the spruce-fir vegetation community is dominated by early-seral stages. A large portion of the community burned in the 1996 Clark Peak Fire or the 2004 Nuttall-Gibson Fire. Severe insect outbreaks affected the remaining spruce-fir. Patches of unburned, late-seral forest exist. In some places, the late-seral forest is growing vigorously and in other areas, it is declining due to fire, dwarf mistletoe, decay, and insect disturbances.

Disturbances in this type typically occur at two spatial and temporal scales: large scale, infrequent disturbances (mostly fire or insects) and small scale, frequent disturbances (fire, insect, dwarf mistletoe, disease, decay, and wind). In the lower elevation spruce-fir, fires occur infrequently and are of mixed severity. In the higher elevation spruce-fir, a decay regime dominates with large, very infrequent, catastrophic fires punctuating the regime. Insects are a common disturbance throughout the spruce-fir community. After disturbance, the spruce-fir community generally recovers slowly, often requiring hundreds of years to reach a late-seral community. Recovery is accelerated when abundant advanced regeneration and seed-bearing trees are present.

Based on projections of future climate change for the region, spruce-fir forest ecosystems are susceptible to decreases in plant productivity (from water limitations and increased heat), increases in insect attacks, colonization by invasive species, longer and more severe fire seasons, and altered frequency, severity, timing, and spatial extent of intense disturbance events (such as droughts, flash floods, landslides, windstorms, and ice storms). Spruce-fir on the Coronado National Forest occurs at the highest elevations and, thus, is among the most susceptible to loss under warmer climatic conditions. Extended drought from a delayed monsoonal season or earlier onset of spring conditions could lead to increased tree mortality and increasing intensity and severity of wildfire.

## Desired Conditions

### *Landscape Scale*

The spruce-fir forest vegetation community is a mosaic of structural and seral stages ranging from young trees to old and is composed of multiple species. The landscape arrangement is an assemblage of variably sized and aged groups and patches of trees and other vegetation similar to historic patterns. Tree canopies are generally more closed than in mixed conifer. An understory consisting of native grass, forbs, or shrubs is present.

Old growth generally occurs over large areas as stands or forests where old growth is concentrated. Old growth includes old trees, dead trees (snags), downed wood (coarse woody debris), and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).

The spruce-fir forest vegetation community is composed predominantly of vigorous trees, but older declining trees are a component and provide snags, top-killed trees, lightning- and fire-scarred trees, and coarse woody debris, all well distributed throughout the landscape. The number of snags and amount of downed logs (greater than 12 inches diameter at mid-point, greater than 8 feet long) and coarse woody debris (greater than 3 inches diameter) vary by seral stage.

The composition, structure, and function of vegetation conditions are resilient to the frequency, extent, and severity of disturbances and climate variability. The forest landscape is a functioning ecosystem that contains all its components, processes, and conditions that result from endemic levels of disturbances (such as insects, diseases, fire, and wind), including old trees, downed logs, and snags. Organic ground cover and herbaceous vegetation provide protection to the soil, allow moisture infiltration, and contribute to plant and animal diversity and ecosystem function. In the lower spruce-fir type, mixed-severity fires (fire regime III) occur infrequently. In the upper spruce-fir type, high-severity fires (fire regime IV and V) occur very infrequently. Natural and human-caused disturbances are sufficient to maintain desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling.

### *Mid-Scale*

At the mid-scale, the size and number of groups and patches vary depending on disturbance, elevation, soil type, aspect, and site productivity. Patch sizes vary but are mostly in the hundreds of acres. There may be frequent, small disturbances, resulting in groups and patches of tens of acres or less. A mosaic of groups and patches of trees, primarily even-aged, that are variable in size, species composition, and age, is present. Grass, forb, and shrub openings created by disturbance may comprise 10 to 100 percent of the mid-scale area, following major disturbance and depending on time since disturbance. Aspen is occasionally present in large patches.

Density ranges from 20 to 250 square feet basal area per acre, depending upon disturbance and seral stages of the groups and patches. Snags 18 inches diameter or greater range from 1 to 3 snags per acre, with the lower range of snags this size associated with early-seral stages and the upper range associated with late-seral stages. Snag density in general (greater than 8 inches diameter) averages 20 per acre with a range of 13 to 30. Coarse woody debris, including downed logs, varies by seral stage, ranging from 5 to 30 tons per acre for early-seral stages, 30 to 40 tons per acre for mid-seral stages, and 40 tons per acre or greater for late-seral stages.

Mixed-severity fires (fire regime III) and other disturbances maintain desired overall tree density, structure, species composition, and coarse woody debris, while less frequent high-severity fires (fire regimes IV and V) reset this forest type to an early-seral stage. Decay processes tend to be the primary nutrient-cycling route in this community.

The wildland-urban interface is comprised primarily of grass, forb, and shrub vegetation. Structures in the wildland-urban interface are surrounded by grassy openings with very few or no trees. These conditions generally result in surface fires.

Forest conditions in goshawk post-fledging family areas are similar to general forest conditions except these forests contain 10 to 20 percent greater tree density (basal area) than goshawk foraging areas and the general forest. Nest areas have forest conditions that are multi-aged but are dominated by large trees with relatively denser canopies than other areas in the spruce-fir type.

### *Fine Scale*

Mid-aged to old trees grow tightly together with interlocking crowns. Trees are generally of the same height and age in early group/patch development but may be multilayered in late development. Small openings (gaps) are present as a result of disturbances. Following disturbance, patch structure may recover slowly.

## Guidelines

1. Vegetation treatments reflect the characteristic structure stage proportions in order to provide continuous representation of old growth and all structure stages on the landscape.
2. Slash from firewood harvest should be managed to a level compatible with the Forest Service's ability to protect the remaining resources.
3. Surveys for reforestation needs should be completed within 2 years following a wildfire or other natural disturbance greater than 200 acres.
4. Natural regeneration of disturbed areas should be allowed where feasible unless the following circumstances exist: (1) endangered species habitat needs to be restored, (2) the time period of recovery is deemed excessive due to the large size of deforested area and/or lack of nearby seed sources, or (3) there is concern for loss of site capacity from soils loss or extreme competition with early-seral species.

## Management Approaches

1. Treating forest pests and diseases, using chemicals if necessary, before they affect forests at the stand level.
2. Preparing for emerging threats such as the spruce aphid and white pine blister rust by surveying for resistant populations, collecting seed, and developing progeny tests (spruce-fir only).
3. Maintaining a seed inventory for each major conifer species based on a seed collection plan approved by the regional geneticist.
4. Developing an overall framework for economic analysis to determine the types of reforestation investments (treatments) needed, determining the least costly manner of executing a treatment, and determining priorities when funding prevents treatment of all acres.
5. Striving to complete identified reforestation needs within 10 years.

## Montane Meadows

### General Description

High-elevation, or montane, meadows generally occur only within mixed-conifer and spruce-fir vegetation types. Meadow size ranges from less than 1 acre to 30 acres. Montane meadows may have a defined channel system, generally at the lowest elevations. Animal species occurring in the montane meadows include the Graham Mountains pocket gopher, long-tailed vole, wild turkey, Atlantis fritillary butterfly, and Weidemeyer's admiral butterfly.

Based on projections of future climate change for the region, montane meadows are susceptible to decreases in plant productivity from water limitations and increased heat, colonization by invasive species, longer and more severe fire seasons, and altered frequency, severity, timing, and spatial extent of disturbance events (such as droughts, flash floods, landslides, windstorms, and ice storms). Montane meadows on the Coronado National Forest occur at the highest elevations and are highly fragmented, making them among the most vulnerable to a changing climate.

### Desired Conditions

Vegetation composition includes junegrass, various sedges and docks, hemlock-parsley, native iris, native onion, and false hellebore. Trees are not common, with the exception of alder, which may be present near the edges of meadows. Soil is not compacted, and over 70 percent of the surface is occupied by plant basal area and herbaceous litter.

### Guidelines

1. Management activities in meadows should not be allowed unless impacts to meadow soils and hydrologic function and native plant assemblages can be mitigated.
2. Meadows should not be used as long-term staging areas for off-highway vehicles or livestock, or for storage of equipment or forest products.
3. When meadows are enlarged through restoration treatments in areas that contain large trees, the resultant meadow edges should retain trees or snags that satisfy wildlife habitat needs, especially for bat roosting.

## Wetlands

### General Description

Wetlands are characterized by low waterflow and soils that are frequently or periodically saturated by ground or surface water. Wetland habitats contain a distinctive native plant community typical of saturated soils. Plants may include sedges, rushes, mosses, monkey flowers, lilies, and algae. These plants occur at wetlands throughout the Coronado National Forest. Animal species occurring in the wetlands include northern raccoon, Arizona treefrog, Northern Mexican gartersnake, and Huachuca springsnail, among other specialized aquatic invertebrates.

Wetlands and cienegas have historic and contemporary significance to area Tribes due to the cultural value of water and because they contain traditionally used resources that are rare on the landscape. In addition, wetland areas provide important recreational opportunities for the public. Historically, wetlands have also been developed and used for agricultural or other cultural needs. In recent times, there has been an emphasis on restoring wetlands due to changes in general perceptions and cultural values regarding wetlands. Therefore, wetlands across the Coronado

National Forest have reverted or have been restored to a functional state that is more representative of natural, benchmark conditions.

Based on projections of future climate change for the region, wetlands are susceptible to decreased soil moisture from increased evaporation and decreased surface water inputs during drought periods. Increased extreme precipitation events could lead to flash floods that could damage vegetation and be too rapid to be absorbed by underlying soils. Decreased rainfall and overall drier conditions can lead to a decreased extent of wetlands and wetland vegetation. It can also cause a change in plant species that are present and/or their distribution within a wetland.

#### Desired Conditions

Waterflow patterns and recharge rates in wetlands are similar to or vary from historic patterns within expected tolerances due to changes in precipitation under an altered climate. Wetlands infiltrate water, recycle nutrients, resist erosion, and otherwise function properly. Plant and animal species that require wetland habitats have healthy, extant populations within the natural constraints of the particular wetland community. Native macroinvertebrates are abundant and diverse. Endemic populations are stable. Nonnative wetland species are nonexistent, or do not significantly impact native species; nonnative grasses are not present, or are present in amounts that do not alter the fire regime.

#### Objective

1. Restore native vegetation and natural waterflow patterns on at least 10 wetland sites every 10 years. (Other relevant objectives are located under “Natural Water Sources.”)

#### Standard

1. The total acreage of existing wetlands will not be diminished due to management activities.

#### Guideline

1. Management activities should only be allowed in wetlands, including wet meadows, if vegetative communities (except noxious and/or invasive plants), soil function and structure, and hydrologic function are kept the same or improved.

### Management Approaches

1. Acquiring, if and when possible, water rights to diversions that are currently limiting wetland recharge and restoring waterflow to as near the natural pattern and volume as possible.
2. Cooperating with conservation groups and agencies to leverage resources and implement projects that remove invasive plants, plant native vegetation, or otherwise assist to restore wetlands.

## Riparian Areas

### General Description

Riparian areas occur throughout all vegetation and stream types. Vegetation supported within riparian areas varies with watershed size, geology, elevation, and aspect. Riparian area health is largely dependent on the storage and movement of sediment and water through the channel system. Natural disturbances (including flooding, scouring, and desiccation) result in changes that

promote a diverse community structure necessary for recruitment of riparian species. Animal species occurring in riparian areas include Arizona gray squirrel, white-nosed coati, gray hawk, elegant trogon, eared quetzal, sulphur-bellied flycatcher, rose-throated becard, canyon spotted whiptail, Northern Mexican gartersnake, Tarahumara frog, and wet canyon talussnail.

Based on future climate projections, riparian areas are susceptible to changes in the frequency, intensity, timing, and spatial extent of extreme weather events (such as droughts, flash floods, landslides, and windstorms). These events, coupled with increased ambient air and soil temperatures, can create corresponding shifts in plant evapotranspiration rates, water quanitity, water infiltration, overland flow, erosion, sediment delivery, and loss of organic ground cover.

## Desired Conditions

Streams and their adjacent flood plains are capable of filtering sediment, capturing bedload, developing and maintaining an appropriate floodplain, improving floodwater retention, and increasing groundwater recharge. Vegetation and root masses stabilize streambanks against the cutting action of water currents. All trees and ground vegetation are native. The ecological condition of riparian areas is resilient to animal and human use. Tree canopy cover is between 30 and 100 percent except where flooding has reduced tree canopy in a post-disturbance community. Soil banks are 60 to 100 percent protected by vegetation, gravel, cobble, rock, or bedrock.

Where water is perennial or intermittent for sufficient duration, streamflows and water quality characteristics (as described in the desired conditions for “Natural Water Sources”) support aquatic wildlife. Riparian areas have characteristics, processes, and features in low departure from reference condition. Water quality, stream channel stability, and aquatic habitats retain their inherent resilience to natural and other disturbances, including climate variability and change. Native fish and other aquatic species are present, and habitat conditions are capable of providing self-sustaining populations. Native fish and amphibian populations are free from, or minimally affected by, nonnative predation and diseases. Habitat and ecological conditions are capable of providing self-sustaining populations of native, riparian-dependent plant and animal species.

Fire rarely burns through this vegetation type, and fire in the surrounding watershed periodically provides slight increases in sediment and water that cause minimal channel modification.

## Objective

1. Treat 2,500 to 10,000 acres of uplands every 10 years with vegetation treatments or soil and watershed restoration treatments to maintain watershed stability and, thereby, the structure and function of streams, flood plains, and riparian vegetation.

## Guidelines

1. New road construction in riparian areas should be avoided, except to cross drainages, unless alternate routes have greater overall resource impacts. If road construction in riparian areas is unavoidable, it should be designed and implemented to minimize effects to natural waterflow, aquatic species, channel morphology, and native vegetation communities.

2. Management activities should only be allowed in riparian areas if soil function and structure, hydrologic function and riparian plant communities (except noxious and/or invasive plants) are kept the same or improved.[12]
3. Vegetation treatments should favor the retention of snags, large diameter woody debris, and/or growth of large riparian trees along stream channels.

### Management Approaches

1. Cooperating with neighboring agencies and landowners when making decisions about managing riparian areas.
2. Developing riparian area classification and condition assessment criteria consistent with the regional riparian mapping project (RMAP) and terrestrial ecological unit inventory.

## Biophysical Features

### General Description

Biophysical features include natural structures such as caves and karst, cliffs, talus slopes, rocky outcrops, rock cavities, and manufactured structures such as abandoned mines. Caves include any naturally occurring void, cavity, recess, or system of interconnected passages beneath the surface of the Earth or within a cliff or ledge and which is large enough to permit a person to enter, whether the entrance is excavated or naturally formed. This definition includes any fissure (large crack), lava tube, natural pit, sinkhole, or other opening which is an extension of a cave entrance or which is an integral part of the cave. Karst features are geological landforms that predominantly result from shaping process controlled by soluble bedrock, usually calceric in nature. Karst landscape is characterized by closed depressions, disappearing streams, and solutional shaping. Karst features create unique microhabitats and are important areas for rapid subsurface drainage and aquifer recharge. Cliffs are any high, steep, or overhanging rock or Earth face. Talus slopes are the accumulation of rock piled up at the base of a cliff, chute, or slope.

Cave resources include any material or substance occurring naturally in caves such as plant and animal life, paleontological deposits, sediments, minerals, cave formations, and cave relief features. Most cave resources are not replaceable and not renewable.

The Coronado National Forest contains many significant caves and karst resources. The Federal Cave Resources Protection Act of 1988 defines a significant cave as a cave located on National Forest System lands that has been evaluated and shown to possess features, characteristics, values, or opportunities in one or more of the following resource areas: biota; cultural; geologic-mineralogic-paleontologic; hydrologic; recreational; or educational-scientific for scientific, educational or recreational purposes; and which has been designated “significant” by the forest supervisor. The Coronado National Forest references the Arizona National Forest Cave and Karst Management Plan, Appendix F – Biophysical Features, current literature, and the best available science when making site-specific decisions relevant to project planning.

Biophysical features occur in all vegetation types and at all elevations throughout the Coronado. These features provide specialized seasonal and year-round habitats for a variety of wildlife species including bats, cliff-nesting birds, talussnails, and several unique montane reptiles and amphibians. Several species of rare plants are adapted for growth on rocky sites and cliff faces.

[12] Plant species present within riparian areas vary with site characteristics such as elevation and slope.

Underground features such as caves may contain unique geological, archaeological, and biological resources. Animal species found in caves and mines range from cave-obligate pseudoscorpions to many species of bats to opportunistic users like black bear, ringtail, and black-tailed rattlesnake. Species associated with rocky areas and cliffs include desert bighorn sheep, peregrine falcon, Yarrow's spiny lizard, rock rattlesnake, twin-spotted rattlesnake, barking frog, and talussnails. Rare plant species found in rocky sites include Bartram's stonecrop, Catalina beardtongue, and many others.

## Desired Conditions

Cliffs and rock outcrops support nesting, roosting, and feeding habitats of birds of prey, desert bighorn sheep, bats, snails, western barking frogs, and other species. Rock climbing and related recreational activities are compatible with the protection of resident wildlife and plant species, and do not diminish the quantity or quality of specialized vegetation and wildlife habitat. Rockslides and talus slopes are undisturbed, providing habitat for wildlife such as lizards, snakes, and land snails. Talus slopes maintain near-historic levels of moisture and are free from excessive sedimentation. Rocky habitats occupied by species of conservation concern are maintained.

Standing dead trees, tree hollows, cavities, loose bark, and downed woody debris are available in all vegetation communities for retention of wildlife values.

Caves provide habitat for species that require specialized conditions for roosting and overwintering, such as bats. Caves maintain moisture and temperature levels consistent with historic conditions. Archaeological, geological, paleontological, and biological features of caves are not disturbed by visitors. Cave formations and relief features continue to develop or erode under natural conditions. Caves known to be important for species of conservation concern are intact or provide habitat for these species. Water flowing into, from, or within the cave system is not altered or diverted in its flow; contains normally fluctuating background levels of sediment, organic matter, and dissolved minerals; and is not polluted. New bat diseases, such as white-nose syndrome (*Pseudogymnoascus destructans*), are not introduced in caves.

Significant cave resources' aesthetic, cultural, and scientific values remain intact, and are protected from damage to provide for use by people and wildlife. Some caves provide a range of recreational and educational opportunities without diminishing the cave resource.

Archaeological, geological, paleontological, hydrological, and biological features of caves are not disturbed by visitors. Cave formations and relief features continue to develop or erode under natural conditions.

## Objective

1. Install an average of two wildlife-friendly closures at mines, caves, or adits[13] when necessary to protect resources or for public safety each year over a 10-year period.

## Standards

1. When closing mine features and caves to public entry, pre-closure inspections shall be conducted to determine if cave dependent or other species are present. Closures will be

[13] An entrance to an underground mine that is horizontal or nearly horizontal, by which the mine can be entered, drained of water, and ventilated.

designed and implemented to address the needs of resident or historically occurring wildlife within the constraints of meeting public safety needs.

2. For caves that have been designated or nominated as "significant," manage to perpetuate those features, characteristics, values, or opportunities for which they were designated.

### Guidelines

Relevant guidelines and standards are also found in the "Vegetation Communities," "Animals and Rare Plants," and "Minerals" sections of this plan.

1. Talus slopes should not be altered and materials should not be removed from them. In areas that harbor talussnails, vegetation treatments should be designed to retain microhabitat characteristics for endemic snails and other talus-dependent species unless as needed to meet statutory requirements, such as mining law or laws to protect public health and safety.
2. Management activities should be designed to avoid or minimize the alteration of naturally occurring rocky outcroppings or cliff faces.
3. Environments in caves and abandoned mines should not be altered except where necessary to protect associated natural resources or to protect health and safety. Where mine closure is necessary to protect human health and safety, closures should preserve habitats for roosting bats and avoid direct impacts to bats.
4. Surface management activities, including drilling, in the vicinity of cave and karst features should avoid actions that would significantly impact underground ecosystems by modifying drainage patterns, subsurface water and airflow, or other natural processes.
5. Identified bat roosts should be managed to provide for the enhancement and protection of bat populations. Protection measures may include seasonal closures, public education, and wildlife-friendly gates.

### Management Approaches

The following management approaches will help to achieve desired conditions and objectives for biophysical features:

1. Managing bat roosts in consultation with State and Federal wildlife agencies.
2. Preparing management prescriptions for caves with important resource, educational or recreational values; hazardous conditions; or heavy use; including information on appropriate use, necessary restrictions, and monitoring requirements. Planning priority is for those caves currently under permit.
3. Engaging caving organizations in cave management activities, such as seasonal surveys, closures, and wildlife-friendly gate development at specific sites.
4. Engaging climbing organizations in cliff management activities, such as seasonal surveys, closures, and education.
5. Monitoring significant caves or other biophysical features to determine visitor impacts and the conditions of key resources in order to protect the ecology of the feature or resource.
6. Periodically updating the list of significant caves on the Coronado.

7. Fostering the collaboration and exchange of information between governmental agencies, partners, and other stakeholders to address conservation, interpretation and education management for cave resources, grottos, and associated species.
8. Educating the public on disease prevention "best practices" for caves.
9. Managing resources to reduce occurrence of vandalism.

## Watersheds

### General Description

The Coronado National Forest generally provides the headwaters and primary source areas for many of the streams in southeastern Arizona. Streams and rivers offer habitat to numerous aquatic and riparian dependent species; provide water for municipal, commercial, and agricultural uses outside of the national forests, and contribute to recharging groundwater aquifers. Watershed conditions and watershed health on the national forests vary depending upon the amount of disturbance that has occurred within each watershed, and the effect of the disturbance on the natural integrity of the watershed as a whole.

All of the surface waters on the Coronado are within Region 15 (Lower Colorado River Region HUC 1),[14] in which three subregions (HUC 2) are represented: 1504 (Upper Gila), 1505 (Middle Gila), and 1508 (Sonora). Subregions are divided into basins (HUC 3), basins are divided into subbasins (HUC 4), and subbasins are divided into watersheds (HUC 5). Project level analysis is typically conducted at the subwatershed level (HUC 6). The Coronado contains 13 subbasins, 51 watersheds, and 249 subwatersheds (HUC 6). Subwatersheds are typically between 10,000 and 40,000 acres in size. Forest subbasins are listed in appendix C of the "Coronado National Forest Ecological Sustainability Report" (USDA FS 2009b).

The Watershed Condition Framework (USDA FS 2011) is the Forest Service procedure for prioritizing watershed restoration at the subwatershed scale. All subwatersheds on the Coronado National Forest have been assessed. Twelve indicators assessed included condition of water quality, water quantity, aquatic habitat, aquatic biota, riparian and wetland vegetation, road and trail networks, soil, fire regime or wildfire effects, rangeland vegetation, terrestrial invasive species, forest cover, and forest health.[15] Each indicator was assessed a numerical score of 1 to 3 based on its condition. Class 1 is defined as functioning properly, class 2 is functioning at risk, and class 3 is impaired function. Each subwatershed was then given an overall rating of functioning properly, functioning at risk, or functionally impaired based on the indicator scores. The results of this assessment are at the following website: http://apps.fs.usda.gov/nfs/nrm/wcatt/WCFMapviewer/.

The Watershed Condition Framework is used to identify priority watersheds for restoration treatments. The Framework also provides a basis for landscape-scale assessments and coordination with other agencies or other private landowners.

[14] HUC = hydrologic unit code; see Glossary
[15] http://www.fs.fed.us/publications/watershed/Watershed_Condition_Framework.pdf

Watershed desired conditions, objectives, guidelines, and management approaches are also outlined elsewhere within the forest plan. Collectively, these plan components help set the desired condition and function for the watershed.[16]

## Desired Conditions

Watersheds on the Coronado National Forest are functioning properly or moving toward functioning properly. Watersheds are dynamic and resilient, and are capable of responding to natural and human-caused disturbances while maintaining the integrity of their biological and physical processes.

Floodplains are functioning properly such that flood impacts to human health, welfare, and safety are reduced. Vertical downcutting and embeddedness are absent in drainages.

Surface runoff, sheet, rill, and gully erosion, and subsequent sedimentation into connecting waters downstream is minimal. Vegetation condition, distribution, density, and amount of litter maintains or improves downstream water quality and quantity. Noxious and/or invasive plant species are nonexistent, or do not significantly affect native plant and animal species or alter the fire regime. Habitat connectivity is maintained.

Water quality meets Arizona and New Mexico water quality standards and supports designated beneficial uses and native and desired nonnative aquatic species.

Short-term exceedance of water quality standards (temporary periods of declining water quality) due to management activity occurs only in the anticipation of long-term improvement of watershed condition and water quality.

Vegetation and root masses stabilize streambanks against the cutting action of water currents. The ecological condition of riparian areas is resilient to animal and human use. Riparian tree canopy cover is between 30 and 100 percent except where flooding has reduced tree canopy in a post-disturbance community. Soil banks are 60 to 100 percent protected by vegetation, gravel, cobble, rock, or bedrock.

Soil condition is satisfactory at all representative test sites on the Coronado National Forest.

## Objective

1. Complete essential projects identified in a watershed restoration action plan for at least one identified priority watershed every 10 years.

## Guidelines

1. The watershed condition framework and classification system should be used to prioritize and assess watersheds.
2. Watershed restoration action plans should be used to guide completion of essential watershed projects.

[16] Desired watershed conditions, objectives, and management approaches are also in the “Vegetation Communities,” “Natural Water Sources,” “Constructed Waters,” “Soil,” “Animals and Rare Plants,” “Invasive Species,” “Motorized Transportation System,” “Recreation,” and “Range Management” sections of this plan.

### Management Approaches

1. Managing watersheds to reduce the potential for catastrophic fire. Projects that reduce catastrophic fire risk and restore the natural vegetative and fuels composition also restore watersheds.
2. Cooperating with conservation groups and agencies to leverage resources, implement projects, and monitor projects that improve vegetative composition, reduce erosion, and/or otherwise improve watershed function.
3. Assessing watershed condition and establishing priority areas for restoration activities.
4. Promoting projects that assist in the protection of municipal supply watersheds.

## Natural Water Sources

### General Description

There are approximately 100 miles of perennial streams on the Coronado National Forest. However, most streams have surface water flowing only periodically. They are the ephemeral and intermittent tributaries to more major streams and drainages, and provide functions relating to hydrologic connectivity, water quality, plant and wildlife habitat, and flood regime in an arid climate. Streams mentioned in this section and elsewhere include ephemeral, intermittent, and perennial streams.

There are about 1,500 springs and seeps on the Coronado National Forest. All streams, springs, and seeps are small, with a low volume of surface water generally present. They are commonly centers of high biological diversity in arid landscapes, and the ecological health of these resources is important for forest ecosystem sustainability. Wildlife is more concentrated around open water sources than in the general landscape. Collectively, streams, springs, and seeps contribute to habitat connectivity for wildlife across the landscape.

Natural waters are also culturally important. Many springs and seeps are developed in a manner that diverts water from the natural source for uses such as providing water for livestock and wildlife, and for domestic use. These uses are important for domestic and commercial interests in and around the Coronado National Forest. In addition, natural waters provide cultural and recreation opportunities.

Natural waters provide water sources that are vital to wildlife. Some species also need natural waters for other critical life history components (such as food, shelter, and reproduction). These include lowland and Chiricahua leopard frogs, Arizona treefrog, Couch’s spadefoot, tiger salamander, Northern Mexican gartersnake, checkered gartersnake, black-necked gartersnake, Gila chub, Gila topminnow, desert sucker, Huachuca springsnail, Stephan’s riffle beetle, predaceous diving beetle, giant water bug, and many species of insects with aquatic larvae. The Sonoran mud turtle is a management indicator species for natural water sources and can be found in the grasslands, Madrean encinal woodlands, and Madrean pine-oak woodlands vegetation communities.

Based on projections of future climate change for the region, natural water sources are susceptible to increased evaporation from warmer temperatures and altered frequency and severity of both droughts and flash floods. Water resources are also at risk due to increased drawdown of aquifers and competing demands for multiple uses. These conditions place additional stress on native species that depend on surface water for their life histories, especially if these species also rely on a narrow range of water temperatures.

## Desired Conditions

### *Landscape Scale*

Watersheds, streams, wetlands, springs ecosystems, and riparian areas have characteristics, processes, and features in low departure from reference condition. Physical and biological properties such as cover, water, shelter, breeding and nesting areas, and forage provide habitat for a diverse community of plant and animal species. Habitat connectivity is maintained. Water quality, stream channel stability, and aquatic habitats retain their inherent resilience to natural and other disturbances, including climate variability and change. Water resources maintain the capability to respond and adjust to disturbances without long term adverse changes. Native fish and amphibian populations are free from, or minimally affected by, nonnative predation and diseases. Vegetation conditions (as described in each section above) contribute to maintaining downstream water quality, quantity, and aquatic habitat features. Upland soil erosion contributes sediment in amounts that do not impair stream function or water quality.

### *Mid-Scale*

Springs and ponds have the necessary soil, water, and vegetation attributes to be healthy and functioning. Spring developments or other natural waters that have been modified for livestock, wildlife, or human consumption purposes remain operational when needed. Developed springs that are no longer needed are dismantled, shut down, and restored to their natural function. They do not create or add to natural resource problems. Instream flows provide for recreational uses and wildlife habitat, including fish. They also provide for channel, floodplain, and riparian maintenance, and recharge of groundwater aquifers. Streamflows provide natural movement among native aquatic species populations. Within the natural capabilities of the water source, water quantity and quality meet the needs of beneficial uses and authorized activities such as domestic and municipal water use, irrigation, stockwater, recreation, wildlife (including fish), road construction and maintenance, and fire management activities. Water is used efficiently with minimal or no waste. Stream channels and flood plains are dynamic and resilient to disturbances.

Stream channel morphology reflects changes in the hydrological balance, runoff, and sediment supply appropriate to the landscape setting. High and low flow events maintain a normal and expected sediment and water balance between streams and their watersheds. Flood plains are functioning and lessen the impacts from floods on human health and safety by dissipating some flood energy and absorbing flood water volume. Water quality meets or exceeds relevant State of Arizona, State of New Mexico, and Environmental Protection Agency standards for designated uses. Water quality meets critical needs of aquatic species. Nonpoint-source loading of streams and lakes from sediment, excessive nutrients, or hazardous chemicals does not reduce water quality below the State standards for Arizona and/or New Mexico.

### *Fine Scale*

Infiltration at outflows allows for soil moisture recharge, supporting the native assemblages of vegetation.

## Objectives

1. Every 10 years, apply for at least 10 instream flow water rights on streams for recreation and wildlife purposes, prioritizing locations necessary for sustaining native fish populations and species of conservation concern.
2. Reconstruct at least 3 developed springs every 10 years to provide aquatic habitat for the recovery of plant and/or animal species.

3. Complete 3 stream restoration and/or development projects to benefit aquatic species of conservation concern every 10 years.

### Guidelines

1. Projects in upland habitats adjacent to streams should be designed to minimize input of sediment to streams.
2. Water quality, quantity, soil function and structure, and wildlife habitat (including aquatic species habitat) should be protected or enhanced at natural springs and seeps.
3. Fuel buildup should be reduced around natural water sources to protect them from uncharacteristic fire effects.
4. Management activities should not impair soil moisture recharge at outflows of natural water sources.
5. Vegetation treatments should favor the retention of snags, large-diameter woody debris, and growth of large riparian trees along stream channels.
6. Fences constructed around natural waters should allow bats and other desirable wildlife to pass through unharmed.
7. New road construction near springs and seeps should be avoided, unless alternate routes have greater overall resource impacts. If road construction near springs and seeps is unavoidable, it should be designed and implemented to minimize effects to natural water flow and aquatic species.
8. Projects affecting perennial streams should be designed and constructed to allow for natural instream movement of aquatic species, except where barriers are necessary to preclude the movement of nonnative species.

### Management Approaches

1. Cooperating with Arizona Department of Environmental Quality and New Mexico Environment Department to meet water quality standards.
2. Actively working with agencies and partners to acquire and maintain water rights, including instream flow water rights.
3. Actively participating in the Gila River water rights adjudication to meet water needs for beneficial uses such as stockwater, recreation, wildlife, irrigation, domestic water use, and other authorized activities.
4. Considering all available techniques for eradicating undesirable aquatic species.
5. Coordinating with conservation groups and agencies to do spring inventory, assessment, restoration, monitoring, and research.
6. Implementing total maximum daily load plans to enable the Coronado to meet or exceed State of Arizona, State of New Mexico, or Environmental Protection Agency water quality standards for designated uses.

# Constructed Waters

## General Description

There are approximately 400 developed springs, 300 wells, and 1,100 stock ponds on the Coronado National Forest. These constructed water features provide surface water resources, in many cases perennial sources, which augment natural water resources. Structures include earthen stockponds, reservoirs, such as tanks, wildlife drinkers,[17] and concrete or steel storage tanks or watering troughs fed by a natural spring, groundwater well, or stream diversion. These facilities can often provide valuable habitat features for native wildlife such as Sonora tiger salamander, but can also harbor invasive aquatic species such as American bullfrogs, crayfish, and green sunfish that prey on or compete with native wildlife. Poorly designed waters can entrap native wildlife or be inaccessible. The Sonoran mud turtle is a management indicator species for constructed waters and can be found in the grasslands, Madrean encinal woodlands, and Madrean pine-oak woodlands vegetation communities. Based on projections of future climate change for the region, constructed water sources are susceptible to increased evaporation from warmer temperatures and altered frequency and severity of both droughts and flash floods. Water resources are also at risk due to increased drawdown of aquifers and competing demands for multiple uses. These conditions place additional stress on native animal species that depend on surface water as a water source. However, a reduction in water availability could lead to a reduction in or slowing of nonnative aquatic species invasions.

## Desired Conditions

Artificial structures for holding standing water (such earthen stock ponds, reservoirs, wildlife drinkers, concrete or steel storage tanks or watering troughs, and habitat restoration ponds) are distributed across the landscape in a pattern and density sufficient to sustain wildlife and livestock. Water sources are perennial where possible, providing a high-quality supply of water and aquatic habitat for plants and animals.

Constructed waters that are used for livestock watering are available for and used by native species. They provide environments that encourage the reproduction of native aquatic organisms and provide important refugia for native wildlife during periods of drought, which are projected to be more frequent under future climate conditions. If aquatic invasive species, such as American bullfrogs, northern crayfish, green sunfish, nonnative tiger salamanders, nonnative mollusks, and nonnative aquatic plants are present, their numbers are low and can be controlled. Waterborne diseases, if present, do not spread among ponds. Water quality is high, and organic pollutants such as nitrates, nitrites, phosphates, and sulfur compounds are at levels that are nontoxic to native species.

## Objective

1. Install wildlife escape ramps in all aboveground constructed waters within 10 years of plan approval.

[17] Tanks of various sizes that can be installed in various locations and environments to collect and store water for use by wildlife.

### Guidelines

1. Wildlife escape ramps should extend to the bottom and near the edge of aboveground constructed waters, and at an angle to avoid entrapment of wildlife in constructed water facilities.
2. Artificial waters constructed for livestock should be designed and/or retrofitted to provide a year-round drinking and habitat resource for native wildlife.
3. Overflow should be diverted to allow for soil moisture recharge and creation or maintenance of wetland habitat features.

### Management Approaches

1. Working closely with U.S. Fish and Wildlife Service and State wildlife management agencies to ensure the viability of native aquatic species.
2. Cooperating with range permittees and State wildlife management agencies to maximize the benefits of artificial water developments for all uses.
3. Considering all available techniques for eradicating undesirable aquatic species.
4. Seeking opportunities to educate the public about the threats posed to native species by invasive aquatic species.
5. Incorporating access features for bats (vegetation and fencing considerations, for example) into designs and layout of new constructed water facilities where feasible and appropriate.

## Soil

### General Description

Soil is the mineral and organic matter that occurs on the land surface throughout all vegetation types. It is characterized by horizons or layers that are distinguishable from the parent material beneath as a result of weathering of that parent material, additions of organic matter, and chemical and physical processes. It is the transition area between air and the parent material beneath, and makes a site capable of supporting vegetation. Soil can be shallow (less than 20 centimeters) or deep (200 centimeters) and may contain varying amounts of sand, silt, and clay particles, as well as all sizes of unweathered rocks. Regardless of the depth, the surface is extremely important, as it must provide for the exchange of gases and water infiltration. Compaction of the surface, removal of the surface layer (erosion), or removal of vegetation can all affect the processes soil carries out in its role of supporting vegetation communities.

Based on projections of future climate change for the region, soils are vulnerable to having decreased water available for plant growth, groundwater recharge, and stream recharge due to increases in evaporation and decreases in precipitation. Longer and more severe fire seasons, and altered frequency, severity, timing, and spatial extent of disturbance events (such as droughts, flash floods, landslides, windstorms, and ice storms) could make soils more susceptible to erosion.

### Desired Conditions

Ecological and hydrologic functions are not impaired by reduced soil quality. The soil quality is satisfactory across the national forest. Vegetation and litter limit the formation of rills, gullies, and pedestals; excessive soil deposition, and topsoil loss. Soils provide for diverse native plant species. Vegetative ground cover is distributed across the soil surface as described for forestwide vegetation community desired conditions and promotes nutrient cycling and water infiltration.

### Objective

1. Every 10 years enhance or restore 2,500 to 15,000 acres of uplands with vegetation treatments or soil and watershed restoration treatments to attain necessary ground cover by litter and ground cover by plant basal area.

### Management Approach

1. Prioritizing watershed improvement projects based on implementing objectives for vegetation communities.

## Air

### General Description

In 1955, Congress passed the first Federal Clean Air Act (P.L.84-159) with later amendments in 1967, 1970, 1977, and 1990. Implementation of this Federal law is largely the responsibility of the states, which may develop programs that are more restrictive than the Clean Air Act requires but never less. The State of Arizona has developed a state implementation plan, and the State of New Mexico has developed a smoke management program; each outlines how the states are implementing the goals of the Clean Air Act, and contains statutes that regulate burning, including use of wildland fire on Federal and state lands. Two types of air quality impacts are addressed by these laws and regulations: health hazards from pollutants and visibility impacts in class I airsheds.

The Clean Air Act establishes National Ambient Air Quality Standards for six principal pollutants that pose health hazards: carbon monoxide, lead, nitrogen dioxide, particulate matter less than 10 microns in size ($PM_{10}$), particulate matter less than 2.5 microns in size ($PM_{2.5}$), ozone, and sulfur dioxide. The major pollutant of concern in smoke from wildland fire, both planned and unplanned ignitions, is fine particulate matter (Ottmar 2001). Particles larger than 10 microns in size tend to settle out of the air; smaller particles remain airborne and can cause respiratory problems. Studies indicate that 90 percent of smoke particles emitted during wildland fires are $PM_{10}$, and about 90 percent of $PM_{10}$ is $PM_{2.5}$ (Ward and Hardy 1991).

Human health studies on the effects of particulate matter indicate that $PM_{2.5}$ is largely responsible for health effects (Dockery et al. 1993). The small size of $PM_{2.5}$ is why it has an especially long residence time in the atmosphere and penetrates deeply into the lungs (Ottmar 2001). The Clean Air Act defines the National Ambient Air Quality Standards for $PM_{2.5}$ as an annual mean of 15 micrograms per cubic meter, and a 24-hour average of 35 micrograms per cubic meter. At this concentration or above, $PM_{2.5}$ is considered to have a detrimental effect on public health. It is important to note that it is not the total amount of emissions from a fire that have effects on human health, but how concentrated pollutants in ambient air are for a period of time. Atmospheric conditions during a fire have a considerable influence on how particulate matter is distributed through the ambient air and its potential to affect public health. Wind speed and

direction, height of atmospheric mixing, atmospheric temperature profile, and atmospheric stability all affect where and how well smoke will disperse.

Regional haze is air pollution that is transported long distances, causing reduced visibility. The same particulate matter that poses human health risks is also largely responsible for impairments to visibility.

In addition to establishing standards for national ambient air quality for airsheds within the U.S., the Clean Air Act established special goals for visibility in many national parks, wilderness areas, and international parks. Through the 1977 amendments to the Clean Air Act, Congress set a national goal for visibility as "the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory class I Federal areas, which impairment results from manmade air pollution." The amendments required the Environmental Protection Agency to issue regulations to assure "reasonable progress" toward meeting the national goal.

Through the 1999 Regional Haze Rule, the Environmental Protection Agency directed states to establish goals for each affected class I area to: (1) improve visibility on the haziest days, and (2) ensure no degradation occurs on the clearest days over the period of each implementation plan.

Air above the Coronado National Forest is divided into five airsheds, four in Arizona, and one in New Mexico. Airsheds are used to describe air quality-related values and impairment by pollutants, including smoke and emissions from permitted activities. The Clean Air Act as amended assigns Federal land managers—in this case the forest supervisor—the responsibility to protect air quality-related values in class I airsheds, and to protect human health, plant and animal health, and visual quality in all areas. There are two class I airsheds within the Coronado National Forest: the Chiricahua Wilderness and Galiuro Wilderness. Two additional class I airsheds are adjacent to the Coronado National Forest: Saguaro National Park and Chiricahua National Monument. Of the various Coronado National Forest programs, fire management has the most notable activities that involve air quality.

Based on projections of future climate change for the region, airsheds are susceptible to increased levels of pollutants (particulates and aerosols) resulting from longer, more severe fire seasons, increased occurrence of warmer air masses that can suspend higher concentrations of pollutants, and frequent or intense windstorms that can transport pollutants and fugitive dust short and long distances.

### Desired Conditions

Air quality above the Coronado National Forest meets Federal and State air quality standards, including standards for visibility and health hazards from pollutants. Air quality-related values, including high quality visual conditions, are maintained within the class I airsheds over the Galiuro and Chiricahua Wilderness areas.

### Guideline

1. Class I and class II airsheds should be considered when determining the response to wildland fires.

## Management Approaches

1. Managing and coordinating the timing, duration, and frequency of planned ignitions throughout the Coronado to minimize regional impacts to air quality.

2. Participating with the States of Arizona and New Mexico in the air quality regulatory process by reviewing air permit applications for new and modified industrial facilities to ensure that their air emissions do not adversely impact the air quality-related values (such as visibility) of federally protected wilderness areas.
3. Coordinating with Arizona Department of Environmental Quality and New Mexico Environmental Department regarding all particulate matter and fugitive dust issues associated with Forest Service activities.

## Animals and Rare Plants

### General Description

The Coronado National Forest has the highest biological diversity of any national forest in the western United States. This is because it is situated at a convergence zone of ecological regions, and has a wide variety of vegetation communities and steep elevation gradients. Biological diversity is further enhanced by a long growing season, bimodal precipitation, and the evolutionary consequences of isolation in the sky island mountain ranges.

The number of species inhabiting the Coronado National Forest and adjoining lands is not precisely known, and new species are periodically described. Conservative estimates include about 2,100 species of plants, 466 species of birds, 110 species of mammals, 91 species of reptiles, over 240 species of butterflies, and nearly 200 species of mollusks.

Based on projected future climate change, terrestrial wildlife species are susceptible to habitat loss and fragmentation resulting from more frequent or extreme disturbance events, including wildfires, droughts, flash floods, landslides, and windstorms. Wildlife species are also susceptible to alterations in the timing of plant phenology events (greenup, flowering, and fruit ripening), especially those that influence critical life behaviors (migration, breeding, and dispersal).

Based on projected future climate change, aquatic species are susceptible to increased water temperatures, altered seasonal discharge events, increases in drought severity during summer flows, and increased predation pressure. There may be decreases in waterflow and, possibly, a shorter period of sustained flows in the spring due to reduced winter snowpack. Sustained flows and desired temperatures in the spring are needed for successful spawning. There also may be the potential for fragmentation of habitat, with resulting increases in competition and predation in pools due to little or no waterflow in some stream segments.

### Desired Conditions

Naturally occurring native ecosystems are present and sustainable across the Coronado National Forest, providing habitat to support a full complement of plants and animals, including sensitive and rare species. Habitats are interconnected within the national forest boundary while the interspaces between ecosystem management areas allow for movement of wide-ranging species and promote natural predator-prey relationships.

Forest boundaries are permeable to animals of all sizes and offer consistent, safe access for ingress and egress of wildlife. In particular, segments of the national forest boundary identified in figure 3 remain critical interfaces that link wildlife habitat on both sides of the boundary.[18]

[18] Boundary areas were selected using data from Arizona's Wildlife Linkages Assessment, an interagency effort available at http://www.azdot.gov/Highways/OES/AZ_WildLife_Linkages/assessment.asp

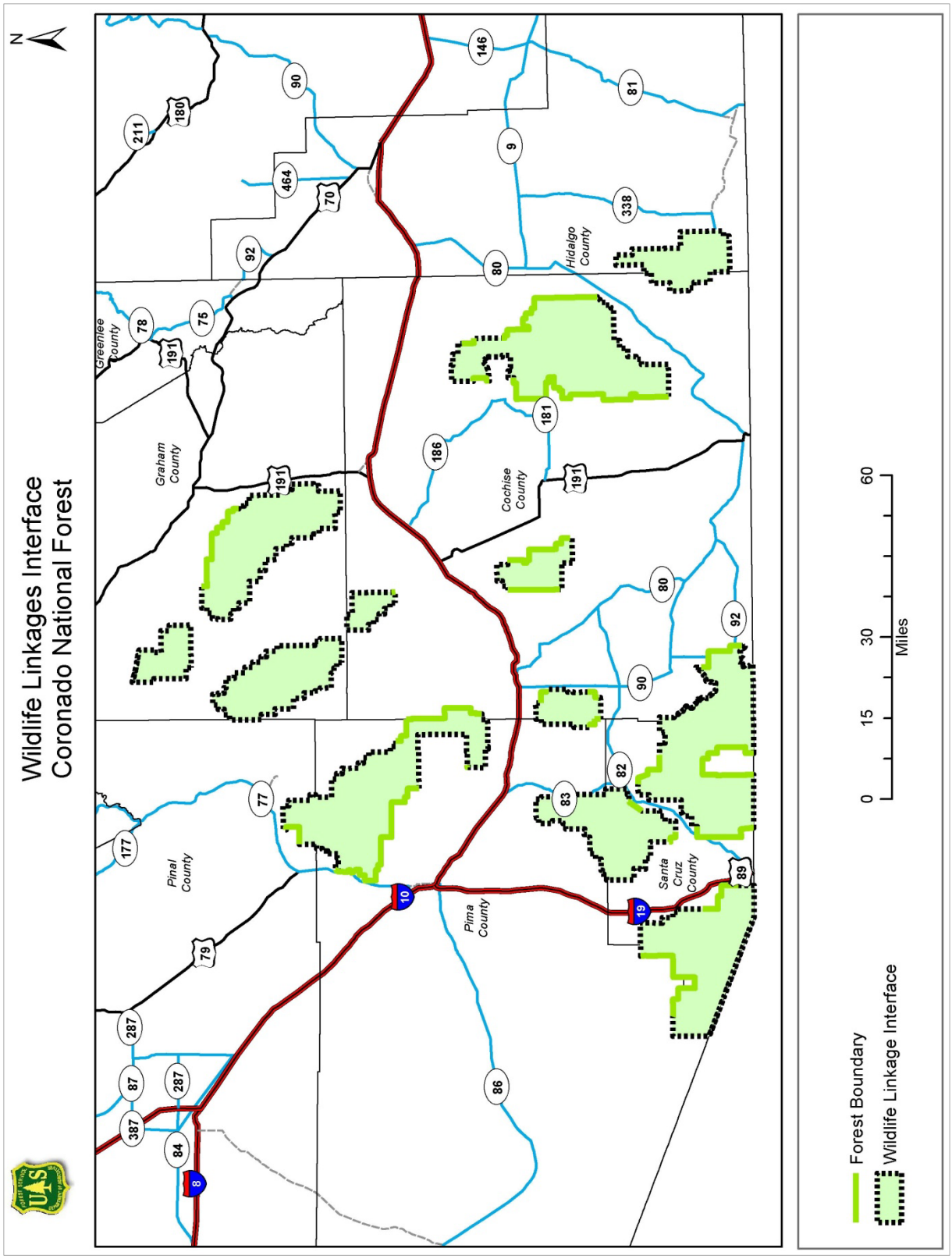


**Figure 3. Map of wildlife linkages interface**

Fences, roads, recreational sites, and other manmade features do not impede animal movement or contribute to habitat fragmentation.

The collection of animals and plants (such as butterflies) does not negatively affect species abundance. Native species that are known to have been present during the first decade of the 21st century continue to exist.

In fire adapted ecosystems, fire adapted native plants are abundant when fire is the critical catalyst used to establish the natural ecosystem process. Trees in terrestrial and riparian areas provide structural features that accommodate arboreal species such as cavity-nesting birds. Naturally occurring ground structures similarly allow for resting, breeding, and foraging activities by a variety of species. Bats and other cave-dependent wildlife have high-quality habitat in caves and abandoned mine features. Permitted activities—such as livestock grazing, outfitter guiding, and ecotourism guiding—do not compromise healthy populations of native species, nor do they adversely impact habitat components. Hunting, fishing, and other wildlife-based recreation activities are encouraged where wildlife populations are flourishing. Human-wildlife conflicts are rare. Nonnative species occur only where populations are manageable and/or desirable; generally, they are rare across the Coronado.

## Guidelines

Guidelines for protecting animals and rare plants are also found in various other sections of chapters 2, 3, and 4.

1. Activities occurring within federally listed species habitat should apply habitat management objectives and species protection measures from approved recovery plans.
2. Where the Forest Service has entered into signed conservation agreements that provide guidance on activities or actions to be carried out by national forest staff, those activities or actions should be undertaken consistent with the guidance found within those conservation agreements.
3. Guidelines for protecting northern goshawks include the following:
    a. A minimum of three goshawk nest areas and three replacement nest areas should be located per goshawk territory. Goshawk nest and replacement nest areas should generally be located in drainages, at the base of slopes, and on northerly (northwest to northeast) aspects. Nest areas should generally be 25 to 30 acres in size.
    b. Goshawk post-fledging areas of approximately 420 acres in size should be designated surrounding nest sites.
    c. In goshawk foraging areas and post-fledging family areas, groups of three to five reserve trees should be retained within management created openings greater than 1 acre in ponderosa pine-evergreen oak and dry mixed-conifer communities, and six reserve trees should be retained within management created openings greater than 0.5 acre in wet mixed-conifer and spruce-fir communities.
    d. In occupied goshawk nest areas, human presence should be minimized between March 1 and September 30 (Reynolds et al. 1992).
4. Active raptor nests on cliff faces should be protected from disturbance during the nesting season.
5. Trashcans and food storage boxes at developed recreation areas should be wildlife resistant.

6. Identified bat roosts should be protected from disturbance during periods of bat occupancy. During nonoccupancy periods, activities should not modify biophysical features that contribute to roost habitat quality or contribute to the spread of diseases harmful to bats unless unavoidable in order to meet statutory requirements, such as mining law or laws to protect public health and safety.

### Management Approaches

1. Maintaining strong partnerships between the Forest Service, State and Federal agencies, county and local governments, and nongovernmental organizations to accomplish conservation planning and management.
2. Using results from the monitoring of management indicator species to design adaptive management strategies to meet species conservation needs.
3. Cooperating and collaborating with State and Federal wildlife management agencies and other partners to monitor and restore wildlife, fish, and rare plant species occurring on National Forest System lands.
4. Coordinating with Animal and Plant Health Inspection Service Wildlife Services and State and Federal wildlife agencies to resolve wildlife resource conflicts on Forest Service administered lands.
5. Cooperating with State and Federal agencies, counties, and municipal governments, and nongovernment organizations to reestablish extirpated species, recover federally listed species, and to manage Forest Service sensitive species in a way that prevents trends toward Federal listing.
6. Coordinating with county, municipal, State, and Federal agencies, adjacent landowners, and nongovernmental organizations to ensure habitat connectivity between sky islands is preserved, restored, and enhanced for wildlife using corridors between ecosystem management areas of the Coronado. In particular, forest boundaries identified as being critical for wildlife ingress and egress (see figure 3) are prioritized during coordinated efforts.
7. Considering potential changes in climate when designing projects and analyzing the effects of proposed projects on wildlife species, especially those species that have been identified as being sensitive to change.
8. Considering the reintroduction of extirpated species to habitats that are reasonably assured to remain suitable through climate change.

## Invasive Species

### General Description

The Forest Service defines invasive species as “alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health” (Executive Order 13112). Alien refers to species that are nonnative to the ecosystem they have infested. Both terrestrial and aquatic invasive species are a growing threat to native species, ecosystem function, and the quantity of forest goods and services. Invasive plants, such as buffelgrass, threaten native plant communities by competing for resources and increasing the frequency and intensity of fire regimes. Even though complete eradication of invasive species is not always possible, aggressive control of existing populations is important to protect native ecosystem diversity.

Based on projections of future climate change for the region, conditions could favor the spread and establishment of invasive species, which are often more widely adapted to a range of climates and often early colonizers following disturbances.

### Desired Conditions

Infestations of invasive exotic plants do not contribute to the loss of native species or impairment of ecosystem function. Invasive animals are nonexistent or occur in low numbers and do not significantly affect the productivity or sustainability of native wildlife.

### Objective

1. See objective for "Desert Communities" on page 24.

### Guideline

1. Habitat improvement and aquatic restoration projects within or adjacent to water sources occupied by ranid frogs (see glossary), Northern Mexican Gartersnake, Sonora tiger salamanders, or native fish should include provisions to remove nonnative invasive animals.

### Management Approaches

1. Detecting and treating new populations of invasive species before they become established.
2. Eradicating or managing invasive species with a coordinated approach using integrated pest management.
3. Coordinating the integrated pest management approach with the plans and efforts of other Federal, State, and local agencies, nongovernmental organizations, volunteers, partners, and landowners.
4. Developing treatment plans and actions that are responsive to current guidance regarding public and ecosystem health, which contribute to the protection and recovery of federally listed and Forest Service sensitive wildlife and plant species.
5. Following the "Forest Service Guide to Noxious Weed Prevention Practices."[19]
6. Working with local governments and communities to discourage the use of non-native species for vegetation and landscaping projects adjacent to the national forest.

## Forest Products

### General Description

Common forest products available from the Coronado National Forest include sawlogs, fuelwood, cactus, and beargrass. Sawlogs and fuelwood are generally available as byproducts of forest restoration or forest fuels reduction projects. Other less common forest products include manzanita, ferns, and mushrooms.

[19] The "Forest Service Guide to Noxious Weed Prevention Practices" describes practices for preventing weed infestations during fire management activities, timber harvest, grazing management, mineral development, recreation, road maintenance, and special use projects. These practices include equipment cleaning, using weed-free hay, seed mixes, and fill materials, and requiring these practices in contracts and special use permits.

It is unclear how a changing climate may alter the availability of forest products in the future. Some species that are more adapted to drier climates may be more abundant, while others may become less abundant. An increased need for fuels reduction and restoration projects to restore ecosystem resilience may increase the availability of sawlogs and fuelwood during some periods.

### Desired Conditions

A sustainable supply of wood products (small roundwood, sawlogs, biomass, fuelwood) and other products (Christmas trees, beargrass, cactus, ferns, and fungi) are provided within the capacity of the land to produce these goods. Results of silvicultural treatments reflect natural disturbance regimes and contribute to ecosystem sustainability. Forest products, particularly those related to wood fiber, are made available as part of fuel treatment projects and restoration activities.

### Standards

1. Harvesting systems should be selected based on their ability to meet desired conditions and not on their ability to provide the greatest dollar return.
2. On lands classified as not suited for timber production, timber harvesting should only be used for making progress toward desired conditions or for salvage, sanitation, public health, or safety, or if needed to meet statutory requirements, such as mining law.

### Guideline

1. Timber harvest activities should be carried out in a manner consistent with maintaining or making progress toward the desired conditions in this plan.

## Management Approaches

1. Making timber and other forest products available for the public through personal use permits or commercial sales.
2. Working with agencies and private organizations to promote forest product use where it is available as a result of forest management activities.
3. Encouraging use of forest products through stewardship contracting in lieu of onsite burning or chipping.
4. Ensuring the continued sustainability of special forest products, such as tree boughs, fuelwood, posts and poles, wildflowers, mushrooms, grasses, seeds, nuts, cones, and berries through monitoring commercial sales and free use permit harvest levels.
5. Recognizing the rights of members of Tribes whose aboriginal territories include the land now administered by the Coronado National Forest to collect forest materials for traditional, cultural, and religious uses.
6. Collaborating through government-to-government agreements with Tribal governments on the management of species important to maintaining the social and cultural well-being of Tribes.

# Minerals

## General Description

There are three categories of minerals potentially found on the Coronado. These are referred to as locatable, leasable, and salable minerals; each is subject to different laws and implementing regulations. Locatable minerals such as gold, silver, and copper are subject to location under the mining laws. The Forest Service role in managing such resources is to provide reasonable protection of surface resources. The agency does not have the authority to outright deny locatable mineral activities providing they follow applicable laws and regulations. Leasable minerals include oil and gas, coal, and certain other commodities such as potash, which is a solid leasable mineral. The Forest Service role in managing such resources is to recommend or consent to the Department of the Interior, Bureau of Land Management whether leases for these commodities should be issued, and specify any surface resource protections that may be needed. The last category, salable minerals, applies to mineral materials such as sand and gravel for which the Forest Service has total discretion to manage. It is Forest Service policy to support responsible, environmentally sound energy and mineral development and reclamation on the Coronado National Forest.

The potential for locatable minerals within the boundaries of the Coronado National Forest is high because the geology of the area is conducive to their creation, and the fault block mountain ranges expose these mineralized zones in a number of places. Locatable mineral resources occur on all ranger districts on the Coronado National Forest. There are numerous active mining claims throughout the Coronado, but most prominently within the Sierra Vista and Nogales Ranger Districts. Pursuant to Federal mining laws, the Forest Service is required to respond to proposals for conducting exploration and mining operations. The Forest Service must determine whether to approve the preliminary plan of operations submitted, or to require changes or additions deemed necessary to meet the requirement of the regulations for environmental protection. All proposals must comply with Federal and State laws and regulations, and should be managed to reduce adverse environmental impacts to the extent practicable on National Forest System lands.

The potential for leasable minerals such as oil or gas is low. However, there is potential for leasable potash minerals bearing the commodity of potassium on the Coronado. The Forest Service would make a recommendation for a lease to the Bureau of Land Management, which is the lead agency for solid leasable potash minerals. Stipulations to protect surface resources would be made for exploration or mining.

Common variety, or salable, minerals have never been a significant component of minerals operations on the Coronado, and there is only one saleable mineral operation in 2013. The Coronado has a handful of active rock pits used for aggregate road base and fill.

## Desired Conditions

Opportunities for environmentally sound minerals development are available. Important wildlife habitats[20] and areas where appropriated funds have been expended are protected through legally appropriate methods from locatable mineral activities. Adverse surface resource impacts are minimized through the appropriate administration of mineral laws and regulations.

All mineral exploration and mining activities are operating in environmentally sound ways through protection and mitigation measures, including adequate post-mining reclamation

[20] Habitat of species having a very limited range and specific habitat requirements not found elsewhere where law and regulation alone do not adequately protect the resource.

assurances, to minimize environmental impacts to other national forest resources. Abandoned and inactive mines disturbed by past mineral exploration and mine development have been returned to stable conditions and an appropriate, functioning, vegetative state, and do not pose health, safety, or environmental hazards.

### Standards

1. Permanent structures and/or occupancy for mining purposes are limited to only those that are necessary and incidental to approved mining operations.
2. Only native or nonpersistent non-native seed and plant materials will be used when revegetating disturbed sites.

### Guidelines

1. Talus slopes should not be used as a common variety mineral materials source where disturbance would destabilize the talus slopes and alter any endemic or rare species habitat or presence.
2. Mine reclamation should use a geomorphic approach that results in landforms similar to adjacent natural terrain and hydrologic functions similar to natural systems to minimize long-term monitoring and maintenance requirements.
3. Mining activities should incorporate reclamation measures that reduce contrasts with the surrounding landscapes.

### Management Approach

1. Using operating plans and bonds for reclamations to protect and restore surface resources.
2. Coordinate with operators, permittees, other agencies, and stakeholders during the environmental review of proposed mineral operations.

## Public Access

### General Description

Public access to the Coronado National Forest is provided through a system of arterial, collector, and local roads and trails, which are interconnected with public roads, highways, and trails (local, county, State, and other Federal) within, adjacent to, and adjoining the national forest. Within the Coronado National Forest boundary, there are numerous scattered private inholdings with roads and trails often crossing these inholdings to access National Forest System lands adjacent to and adjoining them. At the national forest boundary, there are about 300 motorized access points; less than one-third of these provide permanent legal access. Most access points are located at an interface of National Forest System and non-Federal lands (State, county, private, and other ownerships). A number of trailheads located at the national forest boundary provide nonmotorized access to wilderness and National Forest System lands. Many private roads and trails that provide access to National Forest System lands across non-Federal lands (State, county, private, and other ownerships) within and adjacent to the Coronado National Forest have no legal right of public access (written and unwritten title) and may be closed without notice.

## Desired Conditions

Permanent legal access to and within the Coronado National Forest for public and administrative users is available and easily accessible on a system of forest arterial, collector, and local roads and trails that are interconnected with public roads, highways, and trails (local, county, State, and other Federal) adjacent to, adjoining, and within the national forest.

Legal status deficiencies of the existing system of forest roads and trails have been resolved; these roads and trails are available for use by public lands users, unless restricted for administrative purposes.

## Objective

1. Increase the number of permanent legal access routes to and within the Coronado National Forest by resolving the legal status deficiencies of 40 to 50 existing and proposed National Forest System roads and trails, using a variety of methods every 10 years.

## Standard

1. Where an existing road through non-Federal lands (State, county, private, and other ownerships) to and within the Coronado National Forest, which has traditionally provided public access to National Forest System roads and trails, is closed to public use by a non-Federal landowner or agency (State, county, private, and other ownerships) and a right of public access (written or unwritten title) does not exist:
    a. Limit the use of the road(s) across National Forest System lands to administrative purposes or only where specifically authorized under the terms of a permit.
    b. Do not allow ancillary uses of roads that are not open to the public outside the terms of a permit.

## Guidelines

1. Where no legal right of public or administrative access exists (written or unwritten title) or can’t be determined, needed right-of-way easements for existing and proposed roads and trails through non-Federal lands (State, county, private, and others) adjacent to, adjoining, within, or a combination thereof, should be acquired using a variety of methods.
2. If a non-Federal landowner or agency (State, county, private, and other ownerships) is unwilling to grant needed right-of-way easements for an existing or proposed road or trail alignment, the road or trail should be realigned and/or reconstructed. Construction around the non-Federal land onto National Forest System, other Federal, and non-Federal lands (State, county, private, and other ownerships), or a combination thereof, where a permanent legal right of public access exists should be secured unless it is not needed.
3. Exclusive motorized and nonmotorized access routes to the National Forest System roads and trails from adjacent private developments, and subdivisions, and other non-Federal ownerships (State, county, and others) should not be authorized.
4. Access routes to National Forest System roads and trails from adjacent private developments, subdivisions, and other non-Federal ownerships or agencies (State, county, and others) should be available for use by the public. If access is not available to the public, access to the national forest from adjacent private developments, subdivisions, and other non-Federal ownerships should not be authorized.

5. Legal public access to National Forest System lands should not be decreased, unless restricted for Forest Service administrative purposes.[21]

### Management Approaches

1. Determining the legal status of an existing forest road and trail that has been closed by a non-Federal landowner or agency (private, State, county, and other ownerships).
2. Working closely and in partnership with private landowners, county, State, and other Federal agencies, third parties, interested organizations, and individuals to resolve public access issues and to ensure permanent legal public access to the various parts of the Coronado on local, county, State, or permanent National Forest System roads and trails that meet Forest Service management objectives.

## Motorized Transportation System

### General Description

The motorized transportation system available for public use is displayed on motor vehicle use maps. The motor vehicle use maps include designated roads, trails, and areas for each ecosystem management area. The designations include vehicle class, time of year of use, and any designations for motorized use associated with dispersed camping. Motor vehicle use maps are reviewed and updated as needed on an annual basis. The Coronado National Forest motorized transportation system also includes National Forest System roads that are only available for administrative and permitted use. This system of roads is not displayed on the motor vehicle use map.

Based on projections of future climate change for the region, roads are susceptible to the altered frequency, severity, timing, and spatial extent of disturbance events (such as flash floods and landslides). Increased recreational use to escape summer heat could lead to additional wear and tear and heavy use of roads in some areas.

### Desired Conditions

The Coronado National Forest has a designated system of routes open for motor vehicle use by the public. The motorized transportation system is environmentally sustainable and meets public needs and desires under a changing climate. It provides access to National Forest System lands for public and administrative use (see “Public Access”). All roads including access roads to wilderness trailheads or wild backcountry trails and routes are maintained for safe travel by trail users. Visitors are respectful and stay on designated routes: they do not create new routes or expand existing trails, they avoid sensitive habitats like wetlands and meadows, and they cross streams only at fords where the road or trail intersects the stream and redundancy is minimized. Class of vehicle is appropriate for a given road level, and user conflicts are minimal. Arterial access roads are readily identifiable and have surfaces that are suitable for passenger car use and emergency vehicles. There is adequate signing to assist travelers with finding their destination. The occurrence of gullies, washouts, or slides is minimal. Road edges are intact and safe even in excessive traffic areas. There are adequate turnouts or passing areas and adequate sight distances available.

[21] This does not apply to temporary closure orders due to road conditions or public safety.

High-clearance roads and motorized trails are available for exploring the Coronado in off-highway vehicles in a responsible and respectful manner. Users do not cause unacceptable resource damage or create unauthorized routes. Roads are suitable for low traffic volume and low speed. Road surfaces are primarily rough or primitive, but most are available for use by the more experienced traveler with a high ground-clearance vehicle. These roads provide opportunities in appropriate places for safe, responsible motorized recreation and provide varying backcountry touring experiences for a variety of vehicle classes. Long distance loop routes provide opportunities for extended day trips with varying levels of challenge. Where appropriate, motorized trails provide a distinct backcountry touring experience for motorcycles, all-terrain vehicles, and utility-terrain vehicles and minimize conflicts with other visitors.

The existing road system provides adequate access for resource management activities, sufficient legal public access to the Coronado and its amenities such as campgrounds and trailheads, and access for homeland security purposes near the international border. Trailhead parking adequately accommodates vehicles and trucks pulling trailers, where appropriate.

There is an ongoing road maintenance program to prevent damage to resources from roads and to support safe travel by the public in a variety of vehicle types. Unneeded roads, as identified through the transportation analysis planning process, are closed and rehabilitated to reduce human disturbance to wildlife and to reduce soil erosion.

## Objectives

1. Complete maintenance on at least 150 miles of high-clearance (maintenance level 2) roads annually.
2. Complete maintenance on at least 200 miles of passenger car (maintenance levels 3, 4, and 5) roads annually throughout the plan period, based on a safety prioritization.
3. Decommission, close, and restore 3 to 10 miles of unneeded nonsystem roads annually throughout the plan period, except for roads identified for potential public access routes.
4. Install at least one hardened road surface each year at drainage crossings where erosion, sedimentation, or risks to water quality from road-stream crossings are affecting wildlife habitat in order to prevent downstream effects.
5. Realign or remove 2 miles of roads in wetlands or meadows within 10 years of plan implementation.

## Standards

1. Motor vehicle use is allowed on the designated system of roads and motorized trails shown on the motor vehicle use map that is available at each ranger district office. Motor vehicle use is prohibited in all other locations, unless it is specifically authorized by law, permit, and/or orders issued by the Forest Service in conjunction with resource management and public safety actions.
2. Within inventoried roadless areas, roadless character shall be maintained.

## Guidelines

1. Where impacts to archaeological sites from road maintenance are unavoidable, they should be mitigated by adding fill to protect sites, ensuring leadout ditches and other features are not excavated within sites, or by conducting archaeological data recovery (see “Cultural Resources” section).

2. New road construction in meadows and wetlands should be avoided where physically or financially feasible. If these activities are unavoidable, they should be designed and implemented to minimize effects to waterflow, wetland recharge, and ecosystem function.
3. New road construction in riparian areas should be avoided, except to cross the riparian area, unless alternate routes are physically or financially infeasible or have greater overall resource impacts. If these activities are unavoidable, they should be designed and implemented to minimize effects to natural waterflow and native vegetation communities.
4. Construction of roads across highly erodible soils and areas of high and very high scenic integrity should be avoided unless as needed to meet statutory requirements, such as mining law or laws to protect public health and safety.

### Management Approaches

1. Seeking easements and road maintenance agreements with local government agencies and private organizations to supplement Forest Service funded maintenance.
2. Conducting road maintenance activities with the priorities of maintaining public access, protecting the road investment, protecting other resources, user safety, and user economy.
3. Establishing partnerships with local off-highway vehicle user groups and the Arizona State Parks Off-highway Vehicle Ambassador Program to encourage safe, responsible off-highway vehicle use and to improve public outreach and education.
4. Evaluating travel routes (authorized, unauthorized, or closed) to designate motorized trails that provide a distinct backcountry touring experience for motorcycles, all-terrain vehicles, and utility-terrain vehicles where compatible with other resource objectives.
5. Prioritizing road decommissioning for areas that will function as high quality wildlife habitat and quiet areas.
6. Following existing memorandums of understanding, agreements, and guidelines with public road agencies and cooperators regarding operation and maintenance in easements on National Forest System land.

## Recreation

### General Description

The Coronado National Forest offers a rich variety of year-round recreational opportunities in diverse settings, which contributes to the quality of life enjoyed by residents and visitors alike. Some of the most popular recreation activities on the Coronado include hiking, viewing natural features and wildlife, relaxing, driving for pleasure, nature center activities, nature study, picnicking, visiting historic sites, camping, off-highway vehicle riding, fishing, and hunting (USDA FS 2015b). Higher elevations on the Coronado are most popular during the summer, offering temperatures 20 or more degrees cooler than the desert. Higher elevations provide shady conifer forests, lush streams, mountain meadows, and awe-inspiring views across southeastern Arizona. These mountaintop sites also provide opportunities to ski and play in the snow during the winter months. Many of the low elevation recreation areas are located in scenic canyons or foothills, and these sites are most popular during the fall, winter, and spring. Some of the special places on the Coronado National Forest include Sabino Canyon Recreation Area, which hosts a visitor center and a shuttle system, and Mount Lemmon, a scenic byway that climbs from deserts to pines and offers numerous vista points, several campgrounds, and a ski area. There are four

lakes on the Coronado National Forest, providing fishing, boating, and lakeside camping. Madera Canyon and Cave Creek Canyon offer world-renowned birdwatching opportunities. In several locations on the Coronado, visitors can rent historic cabins. Visitors can explore numerous scenic drives on the Coronado National Forest, and three designated scenic byways. Eight wilderness areas provide places to explore and experience quiet and solitude, and there are over 1,100 miles of trail available, including the Arizona National Scenic Trail.

The recreation opportunity spectrum provides a framework that allows the Forest Service to manage a variety of recreation environments for visitors to enjoy. The settings are defined by a number of indicators: access, remoteness, naturalness, facilities and site management, social encounters, visitor impacts, and visitor management. Opportunities are provided along the spectrum from a very high probability of solitude, self-reliance, challenge, and risk (primitive) to very social experiences where self-reliance, challenge, and risk are relatively low (rural or urban) (USDA FS 1986).

Based on projections of future climate change, some recreation sites and transportation networks are susceptible to increased use for relief from increased temperatures in urban areas, and to damage from altered frequency, severity, timing, and spatial extent of disturbance events (such as fires, droughts, flash floods, landslides, and windstorms). Winter activities, such as skiing, may be reduced due to a reduction in snowpack under higher temperatures.

## Desired Conditions

The diverse landscapes of the Coronado National Forest offer a variety of settings for a broad range of recreational opportunities and a place for visitors to escape from busy urban life into quiet, natural, wild places. Landscapes range from primitive settings that provide opportunities for solitude to more developed, rustic settings that provide opportunities for social interaction and greater human comforts. Although development and population in the region continue to grow, recreation settings on the Coronado National Forest are stable, retaining their natural character, and loss of remote, undeveloped settings does not occur. Recreation activities are balanced with the ability of the land to support them and create minimal user conflicts. The Coronado National Forest fulfills a unique and vital role as a place of learning and caring about the environment.

Demand for recreation is accommodated within the capacity of the land to support it, and areas that can accommodate additional use, such as at Peña Blanca Lake, are fully utilized. Recreation on the Coronado National Forest enhances the quality of life for residents and provides tourist destinations, which contribute to local economies. Interpretation and visitor education programs help visitors understand how to reduce their impacts on ecosystems, and visitors actively help support the Coronado National Forest's efforts to protect natural resources and wilderness values. Low-impact recreation principles are promoted and widely practiced by the visiting public.

Developed recreation facilities such as campgrounds and picnic areas provide a range of visitor needs; most areas have simple facilities like picnic tables and vault toilets, while some offer additional amenities such as paved roads, flush toilets, and recreational vehicle hookups. Recreation facilities are clean, in good repair, and provide a safe setting for visitors. Most meet accessibility guidelines. Visitor centers are open to the public on busy days and provide places where visitors can find information and learn about natural and cultural resources on the Coronado National Forest. Heritage sites provide unique opportunities for visitors to connect with the past. Interpretive features help people learn about the special places they visit. Facilities and infrastructure are maintained and replaced as needed. Developed sites blend with the natural setting, and uses in these places do not cause damage to ecologically sensitive areas.

Special use permits augment the variety of suitable outdoor recreation experiences on the Coronado National Forest. Permitted facilities blend well into the natural landscape.

Dispersed recreation activities on the Coronado National Forest include hiking, viewing natural features and wildlife, relaxing, driving for pleasure, nature study, picnicking, camping, off-highway vehicle riding, fishing, and hunting, among others. Visitors use off-highway vehicles responsibly, staying on designated routes and in identified camping areas. Forestwide dispersed recreation sites are small and clean, and resource damage is minimal. Managed activities such as paintballing, geocaching, and rock climbing do not permanently detract from the natural character of the national forest or adversely affect resources.

Opportunities exist for motorized recreation where designated, with varying experiences for a variety of vehicle classes. Forest visitors can enjoy semiprimitive motorized recreation and explore the backcountry in off-highway vehicles along designated routes. Noise from motorized vehicles is infrequent in locations away from areas of higher road density. In other areas, the presence and impact of people and machines is unobtrusive. These areas offer nonmotorized recreation opportunities in a variety of settings that provide differing levels of challenge and seclusion, while limited primitive or high-clearance roads allow for motorized access.

Places such as Redington Pass that receive heavy dispersed recreation use and are within easy driving distance of urban areas provide opportunities for safe, well-managed recreation. Visitors to these areas can enjoy the outdoors in clean, natural settings without conflicts with unsafe or illegal activities, or exposure to excessive noise and disturbance.

A system of well-marked and well-maintained nonmotorized trails provides opportunities for visitors to explore the Coronado's wilderness areas and other places without roads. Wilderness and other settings where visitors can experience quiet and solitude are well dispersed throughout the national forest and easily accessed. Roads to trailheads are open and maintained, and trailheads provide adequate parking and vehicle turnaround space. Damage to resources from trailheads and trails is minimal. Historic trails are preserved and reestablished where appropriate and feasible. Unauthorized user-created ("wildcat") trails are rare.

Visitors enjoy the beautiful scenery, while understanding that fire and vegetation management projects are necessary for the health of vegetation communities within the forest landscape. Recreation sites and settings along the international border with Mexico are clean and border security infrastructure blends well with the landscape. Visitors understand the risks associated with illegal border activity and are informed about appropriate safety precautions.

## Objectives

1. Install wildlife-resistant trash cans at all developed recreation areas and wildlife-resistant food storage boxes at all developed campgrounds within 10 years of plan approval.
2. Evaluate 5 percent of recreation sites annually for conformity with Region 3 Sustainable Recreation Strategy Performance and Accomplishment Measures as applicable.
3. Provide opportunities for volunteers to participate in recreation planning, project implementation, or operations and maintenance at 15 to 30 recreation sites or facilities annually.
4. Manage wilderness areas to minimum stewardship level within 10-years of plan implementation.

### Guidelines

1. The recreation opportunity spectrum framework for guiding recreation planning and management and the Coronado National Forest recreation opportunity spectrum maps should be incorporated into project designs as they are planned and implemented.
2. Recreation sites should be managed for capacities that do not cause unacceptable resource damage or affect the landscape character.
3. When possible, activities that affect visitors should be scheduled outside of the major recreation season.
4. The Coronado National Forest paint color guidelines, the Forest Service's "Built Environment Image Guide" (USDA FS 2001) and the "Coronado National Forest Architectural Guidelines for Recreation Residences" (USDA FS 2015a) should be used for public and private facilities across the Coronado.
5. In recreation areas popular with Spanish-speaking visitors, information should be provided in both English and Spanish.
6. Rock climbing should be managed to balance demand for the activity and the need to protect plants, animals, and other natural resources.

### Management Approaches

1. Using recommendations from various recreation plans (such as concept plans,[22] corridor management plans, and interpretive plans).
2. Completing recreation management plans as needed. This includes concept plans, corridor management plans, interpretive plans, wilderness plans, and others.
3. Encouraging local communities, partnerships, volunteers, and permit holders to help manage a sustainable recreation program, and ensuring that partners are recognized for their roles in providing recreational opportunities.
4. Improving an ongoing trail maintenance program and increasing the capacity of long-term partnerships to help the Forest Service maintain trails.
5. Establishing an ongoing trail maintenance program and developing long-term partnerships to help the Forest Service address international border related impacts such as trail damage and trash.
6. Visiting campgrounds and dispersed sites on a regular basis to make public contacts and ensure fee compliance, provide information, and promote responsible recreation principles.
7. Considering partnership opportunities to promote stewardship and provide sustainable recreation opportunities on the Coronado National Forest.
8. Working closely with the Department of Homeland Security and Border Patrol to manage recreation settings near the international border to ensure visitor safety and reduce associated impacts such as trail damage and litter especially in high use recreation areas such as Cave Creek, Madera Canyon, Pena Blanca Lake, Parker Canyon Lake, and Carr Canyon).

[22] Concept plans are mid-level plans for managing recreation activities and facilities within an area such as Sabino Canyon or Mount Graham.

9. Using the "Coronado National Forest Transition Plan" (USDA FS 2006), "Forest Service Outdoor Recreation Accessibility Guidelines" (USDA FS 2013a), and "Forest Service Trail Accessibility Guidelines" (USDA FS 2013b) to improve accessibility for visitors.
10. Following the "Coronado National Forest Guidelines for Visitor Information Signs" (USDA FS 2014) and developing sign plans as needed for scenic byways and other popular areas to provide improved visitor information and a consistent Forest Service image.
11. Applying for and supporting special area designations (such as National Recreation Area and National Recreation Trail) when appropriate to help manage recreation or enhance recreation opportunities.
12. Developing interpretive facilities and conservation education programs to provide opportunities for visitors and the increasingly urban population in southeastern Arizona to learn about and appreciate nature and wild places.
13. Implementing Travel Management decisions to expand semiprimitive nonmotorized opportunities, allocated motorized vehicle access points for dispersed recreation, increase fiscal efficiencies, reduce environmental impacts, and support quiet recreation experiences.
14. Increasing recreation opportunities within the capacity of the land and fiscal resources to accommodate forest visitors by expanding existing developed recreation sites and encouraging use at underutilized recreation sites.
15. Considering the use of permit and reservation systems to preserve the integrity of the Coronado's natural and cultural resources and to reduce visitor conflicts where recreation impacts cannot otherwise be reasonably managed. Examples include activities in wilderness areas, popular rock climbing locations, and dispersed activities with the potential for resource damage or visitor conflicts.
16. Exploring options for improving off-highway vehicle opportunities by developing or connecting motorized trails.
17. Improving nonmotorized travel opportunities where such access is currently unavailable by constructing new trails or improving existing historic trails.
18. Working with adjacent landowners to maintain the Arizona National Scenic Trail corridor and the condition and character of the surrounding landscape.
19. Working with adjacent landowners to maintain the Arizona Trail corridor and the condition and character of the surrounding landscape.
20. Implementing a sustainable recreation approach consistent with the "Coronado National Forest Sustainable Recreation Action Plan" (USDA FS 2015d).
21. Managing for quiet recreation settings in wilderness, wild backcountry, semi-primitive non-motorized recreation opportunity settings, and other areas.
22. Finding opportunities for creating quiet recreation along level 3, 4, and 5 roads and dispersed camping areas accessible by low clearance vehicles.

## Scenery

### General Description

The Coronado National Forest sky islands are unique among the lands in southeastern Arizona. Scenery on the Coronado National Forest enhances the quality of life for residents and provides

tourist destinations, which contribute to local economies. The mountains provide a spectacular backdrop for residents living in desert cities, and visitors travel into the Coronado to enjoy the natural beauty of these special places year-round. Based on projections of future climate change, scenic landscapes are susceptible to increased use for relief from increased temperatures in urban areas and to damage from altered frequency, severity, timing, and spatial extent of disturbance events (such as fires, droughts, flash floods, landslides, and windstorms).

The Forest Service's Scenery Management System provides a framework for the inventory, analysis, and management of scenery. Five levels of desired scenic integrity are used to manage the Coronado National Forest (scenic integrity objectives): very high, high, moderate, low, and very low. These objectives determine how much alteration from the landscape character is permissible, according to USDA Handbook 701 "Landscape Aesthetics: A Handbook for Scenery Management" (USDA FS 1995). Although scenic natural landscapes are the most valued, buildings and structures are not always considered negative elements. When they add to the sense of place or reflect cultural legacy of an area, they contribute toward scenic integrity. For instance, well-designed campgrounds can enhance recreation opportunities and enjoyment of scenery. The intent of scenic integrity objectives is to achieve the highest possible scenic integrity. Some areas of the Coronado may require restoration in order to move toward or maintain the conditions described in the desired conditions.

## Desired Conditions

Scenic resources on the Coronado National Forest are in excellent condition and are sustainable and resilient to short-term disturbances and climate change. Visitors enjoy vast open spaces and a variety of natural landscapes, including deeply carved desert canyons, riparian corridors with towering sycamores and cottonwoods, rolling native grasslands, oak woodlands, and mountaintop conifer forests. The Coronado's sky islands provide a visual backdrop to cities and roads in the surrounding deserts.

Structures and facilities required for serving public use of scenic and recreation resources include roads, campgrounds, trails, visitor centers, and observation points. To be functional, these facilities are normally visible in immediate foregrounds, but they harmonize with the natural setting. Widely scattered, minor deviations in the landscape character are occasionally seen, such as distribution and telephone lines and range improvement facilities. In the rare instances where visitors see larger utilitarian structures (such as communications towers, transmission lines, astrophysical facilities, and administrative sites), these elements blend into the landscape well because their design and siting follows the line, form, color, texture, and pattern common in the desired landscape character. Mined areas and quarries have been reclaimed and naturalized.

Most landscapes on the Coronado National Forest feature a mosaic of plant species, structures, ages, and densities. Vegetation communities reflect the desired conditions for the associated vegetation type. Mature vegetation and large trees are well distributed on the landscape. Disturbances, including insect and disease outbreaks and wildfire, occur within their natural scale and do not diminish large viewsheds or major portions of any ecosystem management area. Long-term soil and plant productivity, proper functioning ecosystems, and clean water are considered important components of scenic quality. Scenic quality is affected for short periods by vegetation management projects that benefit long-term ecosystem health. Management activities such as vegetation treatments and prescribed fire appear as part of the natural landscape over time and management created debris, such as slash along concern level 1 and 2 travelways, are located and arranged to minimize their visual disturbance in the immediate foreground (up to 300 feet, unless visibility modeling shows that it is less). Treatment boundaries are naturally shaped and blend

with existing vegetation patterns and landscape character and encourage vegetation that screens unsightly elements (such as administrative buildings, communication sites, and mines) from sensitive viewing areas such as campgrounds and trails.

Along scenic byways and other popular travel routes, visitors find occasional developed recreation sites that provide desired amenities (restrooms, picnic tables, and so forth), but these facilities are in character with the National Forest System setting. Occasionally, visitors see unique historic sites; these areas are positive scenic elements, providing a glimpse of times past. Private cabins appear rustic and blend with the landscape. New facilities are rare, and they blend well into the landscape. Landscapes away from roads provide opportunities for dispersed recreation, solitude, and spending time in pristine wildlands with minimal evidence of human activity.

## Standard

1. Only native or nonpersistent non-native seed and plant materials will be used when revegetating disturbed sites.

## Guidelines

1. Projects should use the Coronado National Forest Scenery Management System maps (USDA FS 2015c) (including scenic integrity, scenic class, and concern levels) and meet scenic integrity objectives. [23] Additionally, projects should use the scenery management system implementation guide during project design and planning.
2. Facilities should be designed to complement the landscape by siting them to reduce scenic impacts, using dark, neutral colors, and repeating the line, form, texture, pattern, and scale of the landscape to blend structures into their surroundings. This applies to public recreation sites, administrative sites, facilities owned by other government agencies (except for Department of Homeland Security), and permitted structures. Facilities associated with locatable mining activities should blend with the natural background.
3. Department of Homeland Security should attempt to use mitigation measures at their facilities[24] to minimize impacts to scenic quality.
4. For vegetation management and forest health improvement projects:
    a. Scenic integrity objectives may be temporarily lowered in the short term if necessary to meet project objectives, but should meet scenic integrity objectives over the long term.[25]
    b. Vegetation management projects should mimic natural vegetation patterns, design treatment boundaries to blend with surrounding landscape, avoid even spacing of retained trees, leave a diversity of tree species and sizes, avoid damage to vegetation that will remain, avoid removing or burning vegetation that screens unsightly facilities, and naturalize disturbed areas.
    c. Prescribed slash treatment in the immediate foreground (up to 300 feet) of concern level 1 and 2 travelways should be completed as soon as conditions permit.

[23] https://www.fs.usda.gov/detail/coronado/landmanagement/resourcemanagement/?cid=stelprdb5123248
[24] Department of Homeland Security facilities may be noticeable throughout the ranger districts along the international border. Locations are not shown on the scenic integrity objectives map.
[25] Provide written documentation in the project-level analysis and decision that defines “short term” and “long term” for the project, and describes the timeline for completion and final expectations for appearance.

d. Healthy large trees should be favored as a larger proportion of the immediate foreground along concern level 1 and 2 travelways, unless doing so would not achieve project goals.

e. In the immediate foreground along concern level 1 and 2 travelways, trees should be marked in a manner that minimizes long-term visual effects and stumps should be treated to reduce their visibility by methods such as cutting as low as possible (no more than 6 inches above ground on uphill side) and angling large stump faces away from viewing locations unless doing so would pose a safety hazard.

f. Log decks should be removed, and actions should be taken to naturalize disturbed areas such as skid trails landings, and temporary roads as soon as conditions permit. If trails are used as skid trails or haul roads, trail should be cleaned up and rehabilitated.

5. Effects from prescribed fire should be considered during project planning and implementation. Blackened and scorched vegetation may be visible in project areas in the short term following treatments, but scenic integrity objectives should be met in the long term, though blackened trunks may remain visible.

6. Range facilities[26] are allowed in all scenic integrity objectives, but should use mitigation measures to minimize impacts to scenic quality.

7. New facilities added to communication sites, astrophysical complexes, and administrative sites should be clustered within existing areas. Facility colors and materials should blend with the landscape, structures should generally be below the height of vegetation, and vegetation that screens views to facilities should be protected and encouraged unless doing so would not achieve project goals.

8. Activities that affect scenic quality should be scheduled outside of the major recreation season, unless doing so would not achieve project goals or would conflict with wildlife restrictions.

9. New utility lines should be buried in areas with sensitive scenic resources, such as areas along scenic byways, nationally designated trails, and within recreation areas unless as needed to meet statutory requirements, such as mining law or laws to protect public health and safety. Existing utility lines that do not meet scenic integrity objectives should be buried or relocated to reduce scenic impacts whenever opportunities become available (such as when poles are replaced).

10. Active mineral exploration may not meet the scenic integrity objectives in the short term.[27] Exploratory mining drill pads and temporary access roads should be reclaimed by recontouring topography and revegetating sites so they mimic adjacent landscapes after project completion to meet scenic integrity objectives.

11. Mines and quarries should be reclaimed by shaping topography and vegetating sites so that they blend with adjacent landscapes unless doing so would cause greater resource impacts.

[26] Range facilities may be noticeable throughout ranger districts on the Coronado National Forest. Locations are not shown on the scenic integrity objectives map.

[27] Provide written documentation in the project-level analysis and decision that defines “short term” and “long term” for the project, and describes the timeline for completion and final expectations for appearance.

### Management Approaches

1. Restoring scenic quality in areas where it has been negatively impacted as other project work is accomplished and/or funds are available.
2. Applying for and/or supporting special area designations (such as scenic byways and national scenic trails), where appropriate, to help protect scenic resources.
3. Considering the use of interpretive signs at the site of vegetation treatments and natural disturbances to inform the public about the nature and consequences of such projects or events.
4. Cooperating with other entities, such as the Arizona Department of Transportation, local governments, and commercial and private entities to protect scenic integrity on and adjacent to the national forest, including along scenic byways.
5. Improving areas with poor existing scenic conditions (areas with existing scenic integrity of low, very low, or unacceptably low) by removing unwanted facilities and revegetating bare ground.
6. Removing facilities (buildings, utility poles/lines, and other structures) that are no longer useful, unless they are historic or desired features.
7. Working with landowners, communities, local governments, and partners to promote voluntary open space conservation.
8. Updating the corporate scenic integrity objective map if there are permanent changes to scenic integrity objectives.

## Special Uses

### General Description

The Coronado National Forest administers over 620 special use authorizations. These uses include such activities as outfitting and guiding, research, various types of utility lines, communications sites, road permits and easements, and recreation residences. Also included are permits for campground, marina, and store facilities; filming; and numerous recreation events. The Coronado National Forest also supports, through the permitting process, military, local law enforcement, and Department of Homeland Security activities.

### Desired Conditions

Special use activities on National Forest System lands provide needed services to communities that cannot be reasonably accommodated on non-Federal lands. These activities supplement and complement services that the Coronado National Forest provides. Environmental, social, and visual impacts are minimized; the permit area and duration are the minimum necessary to accommodate the use.

### Objective

1. Phase out permits for isolated cabins and privately owned residences that are not part of the recreation residence program by 2028.

## Standards

1. A special use permit is required for collection of plants or animals for commercial purposes.
2. Major utility corridor development is confined to the area identified and mapped in the 2008 "West-wide Energy Corridor Programmatic EIS."
3. Communications sites will be managed to the following standards:
    a. Maximize the colocation of new and existing buildings and structures.
    b. Site use shall be allocated to users on a facility-need basis.
    c. Maintenance of National Forest System roads and trails to access communication sites, above and beyond normal Forest Service maintenance, or use and maintenance of private roads, will be carried out by the facility owner or association only after obtaining the proper authorizing document (such as a road use permit).
    d. Clearing of vegetation will be limited to that which poses a hazard to facilities and operational efficiency (see the communication site plan for further direction).
    e. High- and low-power communication uses will be authorized only where designated as such in the communications site plans. Any potential electromagnetic interference must be resolved by the site users before construction can proceed. Senior uses on a site have priority over new or proposed uses. Microwave corridors will be protected from electromagnetic interference.
    f. All new and replacement towers must be self-supporting.[28]
    g. New and replacement antennas and towers will be below the height for which the Federal Aviation Administration requires lights because of the interference with the fire lookout tower and aesthetics.
    h. All utility lines connecting to communications sites will be buried underground.
    i. All buildings and towers will meet color requirements set forth in the Coronado National Forest's "Architectural Guidelines for Recreation Residences" (USDA FS 2015a). Microwave dishes will use dark grey/brown covers. Other antennas will be dark grey/brown, when available through the manufacturer.
4. Limit motorized special use activities to existing National Forest System roads and motorized trails.
5. Require obliteration of non-National Forest System trails created by activities authorized under special use permits when the permit expires.

## Guidelines

1. Facilities should be sited and designed to blend into the landscape as much as possible. Whenever possible, heights of structures should be kept below the height of surrounding vegetation, and vegetation that screens views to utilitarian facilities should be protected and encouraged.

[28] Self-supporting towers do not have supporting structures or wires and, therefore, minimize land area impacts.

2. Phone and power distribution lines that cross National Forest System lands to access private inholdings or Forest Service facilities should be located and designed so as to be screened by topography or vegetation as much as possible.
3. Phone or power distribution line requests to cross National Forest System lands to access private lands outside the national forest boundary should not be permitted outside of existing utility corridors.
4. New or reconstructed utility lines should be placed underground when possible to protect scenic resources, unless this is not feasible because of overriding environmental concerns or technical considerations.
5. New electric transmission lines and natural gas pipelines should be located in existing corridors that meet the scenic integrity objective. Existing corridors that do not meet the scenic integrity objective should be relocated when construction becomes necessary.
6. Public road or trail access to special use areas such as communication sites should not be restricted unless there are security, safety, or other concerns.
7. Requests for permits or easements for private gates, driveways, trails, or roads to cross National Forest System lands to access private lands located outside the national forest boundary should be denied unless a public benefit can be shown, such as a reciprocal easement.

### Management Approaches

1. Maintaining existing communications sites and completing site management plans for all sites with the cooperation of communication site user groups.
2. Continuing to establish user groups or organizations for each site.
3. Using the policy for management of recreational residences as outlined in the "Architectural Guidelines for Recreation Residences on the Coronado National Forest" (USDA FS 2015a) (the guidelines). Managing items not covered in the guidelines with input from a committee consisting of the district rangers of Douglas, Safford, and Santa Catalina Ranger Districts and the forest supervisor or deputy forest supervisor.

## Cultural Resources

### General Description

Coronado National Forest heritage resources provide the public with opportunities to gain a broader understanding of the 12,000-year history of human habitation in southeastern Arizona. Cultural resources help people connect with the past, not only to enhance their sense of time and place, but also to illuminate aspects of Arizona history that are relevant to modern life and land use decisions. The unique geographical configuration of the Coronado National Forest, with its relatively small isolated mountain ranges, has strongly influenced the patterns of human use throughout the region. Major occupation sites by Native American peoples are concentrated in the lower elevations of the ranges in adjacent valleys, while the mountainous portions of the ranges are the focus of more limited activities such as resource gathering. The Coronado National Forest also has a rich historic period record of mining, ranching, and Forest Service administration.

## Desired Conditions

Cultural resources on the Coronado National Forest, including known Native American sacred sites and traditional cultural properties, are preserved, protected, and/or restored for their cultural and scientific importance. Efforts are made to avoid adverse effects to historic properties, and to develop appropriate mitigation measures in cases where adverse effects cannot be avoided. Landscapes, sites, traditions, and stories contribute to the community's appreciation of the diverse human communities who have lived in the region and how they adapted to the cultural and physical environment. As appropriate, historically significant cultural properties are listed on the National Register of Historic Places. The Coronado's priority cultural resource assets are protected and preserved. Archaeological, ethnographic, and historical data guide efforts to manage current ecosystems and, in some cases, restore historic ones.

Forest facilities that are eligible for the National Register of Historic Places are available for continued use, for Forest Service administration, public recreation and interpretation, and Tribal events, as appropriate. Collaborative partnerships and volunteer efforts are developed and maintained to assist the Forest Service in managing its cultural resources. Important archaeological artifacts are protected, either in place in their original contexts or in secure curation facilities. The Coronado's historic documents, including photographs, maps, journals, and program management records, are available for research and interpretation by the Forest Service, other agencies, universities, Tribes, and the public.

## Objectives

1. Complete 200 acres of nonproject inventory each year, so that the Coronado's currently unidentified cultural resources can be recorded, evaluated, and protected.
2. Nominate at least five individual sites or at least two districts to the National Register of Historic Places within 10 years of plan approval.
3. Conduct stabilization or preservation activities at one or more priority heritage assets[29] each year.
4. Host, sponsor, or participate in at least two interpretive events for the public every year.
5. Provide opportunities for volunteers to participate in heritage resource conservation activities at two to five archaeological sites or historic properties every year.
6. Within 10 years of plan approval, enter at least two historic sites in the Arizona "Rooms with a View" cabin rental program.
7. Inspect each priority heritage asset at least once every 5 years.

## Guidelines

1. Contracts, permits, and leases that have the potential to affect cultural resources should include appropriate clauses on protection responsibilities and liability for damage.
2. Historic values should be considered in the development and modification of facilities.

[29] Priority heritage assets are historically significant cultural resource sites or buildings that the Coronado has invested funds in to preserve, provide interpretation, or use.

### Management Approaches

1. Maintaining and enhancing coordination and cooperation with other land management agencies, Tribes, and public-private alliances that advance the stewardship of the Nation's diverse heritage. Cooperative efforts can include: (1) fostering the educational, aesthetic, inspirational, cultural, and economic benefits of historic preservation and conservation as outlined in the Arizona State Historic Preservation Plan; (2) encouraging public interpretation at historic sites where it contributes to the region's sense of community and intercultural understanding; and (3) facilitating cross-boundary heritage tourism to contribute to the region's economy and sense of place.
2. Maintaining and enhancing the partnerships with Tribes, universities, professional organizations, and volunteers who play an integral role in the management of cultural resources.
3. Developing appropriate measures to protect cultural resources from deterioration due to natural forces, visitor use, and vandalism. Protective measures may include signing, fencing, administrative closure, patrolling, interpretive signs, landscape treatments and revegetation projects, and stabilization or data recovery.
4. Pursuing opportunities to interpret cultural resources to the public. Onsite interpretation can include interpretive trails, signs, exhibits, or self-guided and specialist-guided tours at historic and prehistoric sites. Offsite interpretation can include lectures, professional publications, brochures, programs, and displays. Interpretation of cultural resources can be integrated with other resource interpretation and with recreation facilities and programs. The Forest Service can pursue opportunities to develop cooperative efforts with other Federal and State agencies interested in cultural resource interpretation, such as the Bureau of Land Management and other national forests, and with private partners.
5. Managing architectural properties that are listed on or eligible for the National Register of Historic Places for maintenance, rehabilitation, and reuse, in accordance with the Secretary of the Interior's standards and guidelines.
6. Prioritizing areas for nonproject-related survey as follows: (1) areas suspected to have high site density; (2) areas suspected to have underrepresented site types; (3) areas of traditional importance to Tribes; (4) areas where site densities or ongoing impacts are unknown and need to be assessed; and (5) areas subject to future development and disturbance.
7. Developing a database of fire sensitive sites and structures that would be available for fire management planning purposes and for facilitating resource protection.
8. Incorporating digitized historic maps or plats into a geographic information system database.

## Tribal Relations

### General Description

The Coronado National Forest maintains a governmental relationship with 12 federally recognized American Indian Tribes that have aboriginal territories and traditional ties to the land now administered by the Coronado National Forest. Federally recognized American Indian Tribes are sovereign nations; therefore, the Forest Service strives to establish and maintain government-to-government relationships with each Tribe. The Coronado National Forest carries out its government-to-government trust responsibilities under a variety of Federal authorities. The Forest Service has Federal trust responsibilities to American Indian Tribes. In meeting these

responsibilities, Coronado National Forest managers consult with Tribes when proposed policies or management actions may affect their interests. Many Tribal members regularly visit these lands to gather traditional resources and to visit traditional cultural properties and sacred sites. Therefore, Tribes share an interest in protecting important natural and cultural resources.

Tribes with cultural ties to the land now administered by the Coronado National Forest include the Ak-Chin Indian Community, Fort Sill Apache Tribe, Gila River Indian Community, Hopi Tribe, Mescalero Apache Tribe, Pascua Yaqui, Pueblo of Zuni, Salt River Pima-Maricopa Indian Community, San Carlos Apache Tribe, Tohono O'odham Nation, White Mountain Apache Tribe, and Yavapai-Apache Nation. All Tribes with traditional connections to lands that are now part of the Coronado National Forest are recognized as having roles in the stewardship of the land.

Under a changing climate, some forest products for traditional Tribal uses may be vulnerable to more frequent or extreme disturbance events, including wildfires, droughts, flash floods, landslides, and windstorms.

## Desired Conditions

Traditional lands on the Coronado provide a setting for education in culture, history, and land stewardship. Interpretive and educational exhibits, events, and other media that focus on the history of the lands now managed by the Coronado National Forest provide the public with a greater understanding and appreciation of native history, culture, and traditions.

Traditional Tribal uses such as the collection of medicinal plants, wild plant foods, basketry materials, and fuelwood take place on the Coronado National Forest. Tribal members have access to sacred sites for traditional ceremonies and rituals, and the integrity of sacred sites is maintained or improved whenever feasible. When available, Forest Service administrative sites can be used by Tribal families and organizations through government-to-government agreements.

## Management Approaches

1. Consulting with Tribes to identify sacred sites or traditional cultural properties and to develop a strategy for appropriate recognition and management, including honoring Tribes' requests for maintaining confidentiality.
2. Upholding the Federal trust responsibilities and government-to-government relationships with Tribes through agreements.
3. Working together with Tribes to build respectful, collaborative relationships; to develop ways of accomplishing mutual desired conditions and objectives; and to collaborate in ecosystem restoration efforts.
4. Cooperatively develop a memorandum of understanding with neighboring Tribes for routine Tribal consultation, policy development, proposed plans, projects, programs, and forest activities that have a potential to affect Tribal interest.
5. Making recreational or administrative sites available for use by Tribal families and organizations through government-to-government agreements.
6. Consulting with Tribes at early stages of planning and project design, so that Tribal perspectives, needs, and concerns—as well as traditional knowledge—can be incorporated into project design and decisions.

7. Collaborating with Tribes, Federal and State agencies, private foundations, and landowners to emphasize management by landscape rather than jurisdiction, so that Tribes, the public, contractors, and researchers can cross from one Federal agency's jurisdiction to another.
8. Identifying opportunities where locations on the Coronado can provide a setting for the education of Tribal youth in culture, history, and land stewardship.
9. Developing interpretive and educational exhibits or other media that focus on the history of the Coronado in collaboration with Tribes to provide the public with a greater understanding and appreciation of our shared history, culture, and traditions.
10. Providing Forest Service employees opportunities to receive training so they understand the unique legal relationship between the Federal government and Indian Tribes, set forth in the U.S. Constitution, treaties, statutes, executive orders, and court decisions.
11. Providing opportunities for Tribal members to engage in traditional activities, such as the collection of medicinal plants, wild plant foods, basketry materials, and fuelwood for personal use.
12. Ensuring that Tribal members have access to sacred sites for individual and group prayer and traditional ceremonies and rituals, and that the integrity of sacred sites is maintained or improved whenever feasible.

## Range Management

### General Description

The focus of range management on the Coronado National Forest is the production of a diverse array of tangible and intangible products. Tangible products include forage for grazing and browsing livestock and wildlife. Intangible products include natural beauty and quiet places. Livestock grazing is permitted on about 90 percent of the Coronado National Forest. Grazing use is administered through a grazing permit system on designated livestock grazing allotments.

Based on projections of future climate change, conditions may be preferable for grassland habitat. However, suitable forage for grazing or browsing and availability of water for livestock may be reduced during extended drought periods, and increased disturbances could favor nonnative species that are not suitable for grazing.

### Desired Conditions

The Coronado National Forest provides forage for grazing in support of domestic livestock production as a viable, sustainable economic activity. Communities surrounding the Coronado National Forest benefit from the interactions of livestock production activities with other economic sectors, and from the social, cultural, and ecological values tied to conservation ranching.

Domestic livestock grazing does not move the landscape away from the desired composition and structure of plant communities. Rangeland ecosystems are diverse, resilient, and functioning within a healthy, sustainable landscape in the face of a changing climate. Areas that are grazed have stable soils, functional hydrology, and biotic integrity, while supporting healthy, diverse populations of native wildlife.

By supporting livestock production on working landscapes with an extensive, low impact land use, the Coronado National Forest contributes to preserving large areas of unfragmented open

space. These open spaces sustain biological diversity and ecological processes and help to preserve the rural cultural heritage of southeastern Arizona and southwestern New Mexico.

## Standards

1. Grazing permits for domestic goats and/or sheep will not be issued in the Santa Teresa, Winchester, Galiuro, and Santa Catalina Ecosystem Management Areas to prevent the transfer of disease from domestic goats and sheep to wild populations of bighorn sheep.
2. New issuance, renewal, modification, and management of grazing permits shall comply with the Coronado National Forest's "Stockpond and Aquatic Habitat Management and Maintenance Guidelines for the Chiricahua Leopard Frog." Additionally, for the San Rafael Valley and surrounding areas, permits shall comply with the Coronado National Forest's "Stockpond Management and Maintenance Plan for the Sonora Tiger Salamander."
3. In areas occupied by lowland leopard frogs, stock ponds will be managed according to the general guidance, as applicable, of the Coronado National Forest's "Stock Pond and Aquatic Habitat Management Guidelines for Chiricahua Leopard Frog" (if lowlands are included in the revised guidelines, then this no longer applies).

## Guidelines

1. Forage utilization should be based on site-specific resource conditions and management objectives, but in general should be managed at a level corresponding to light to moderate intensity (15 to 45 percent of current year's growth). Exceptions may be allowed in order to meet objectives related to scientific studies, fuels reduction, invasive plant control, or other targeted grazing or site-specific objectives.
2. Burned areas should be given sufficient deferment from grazing, especially during the growing season, to ensure plant recovery and vigor.
3. Construction or reconstruction of livestock fencing and replacement of nonpermeable fencing where wildlife movement is restricted should be consistent with the appropriate state wildlife agency standards[30] for safe passage of wildlife and/or species-specific fencing guidelines developed at the local or regional level.[31]
4. Grazing management practices should be designed to maintain or promote ground cover that will provide for infiltration, permeability, soil moisture storage, and soil stability appropriate for the ecological zone. Additionally, grazing management should retain ground cover sufficient for the forage and cover needs of native wildlife species.
5. Within riparian areas, structures used to manage livestock should be located and used in a way that does not conflict with riparian functions and processes.
6. Treatments for restoring rangelands should emphasize the use and perpetuation of native plant species.
7. Grazing intensity, frequency, occurrence, and period should provide for growth and reproduction of desired plant species while maintaining or enhancing habitat for wildlife.

[30] For Arizona Game and Fish Department, refer to the most recent Wildlife Water Construction Standards section on standard wildlife fencing; for New Mexico Game and Fish Department, use available habitat or species-specific guidelines.

[31] Examples include those found in products developed by working groups or collaboratives of wildlife agencies, academics, and research or management organizations.

8. Management practices to achieve desired plant communities should consider protection and conservation of known cultural resources, including historical sites, prehistoric sites, and plants of significance to Native American peoples.

### Management Approaches

1. Following the monitoring protocols found in the Forest Service's Southwestern Region "Rangeland Management Training Guide," "Technical Interagency Guide," and "Principles of Obtaining and Interpreting Utilization Data on Rangelands."
2. Collaborating with permittees, other agencies, University of Arizona Cooperative Extension, and other stakeholders to develop consistency in monitoring protocols and to leverage resources to accomplish landscape-scale monitoring.
3. Reviewing current management of each active allotment at a minimum prior to the reissuance of an expiring permit to identify consistency with current grazing authorization decisions (completed according to National Environmental Policy Act requirements).
4. Annually meeting with permittee to discuss timing, intensity, duration, and frequency of livestock use, as well as infrastructure needs.
5. Establishing, where feasible, grass reserves to help facilitate restoration work, while providing for permittee considerations.

## Land Ownership Adjustments and Boundary Management

### General Description

The sky islands nature of the Coronado National Forest combined with the current complex land ownership pattern within and next to the Coronado leads to the need for an intensive and extensive land ownership adjustment and boundary management program. This program includes land ownership adjustments (donation, purchase, land exchange, and limited sales), withdrawals, right-of-way acquisition, landline location, and boundary modifications. Landline location surveys ensure that boundary lines are accurate. All of these programs ensure that public access, watershed protection, wildlife habitat, recreation, open space, and scenic resources continue to flourish on the Coronado National Forest.

### Desired Conditions

The land ownership pattern within the boundaries of the Coronado National Forest is characterized by large contiguous blocks of National Forest System land. Complex and fragmented land ownership patterns have been consolidated through collaborative land adjustments with non-Federal landowners or agencies (State, county, private, and other ownerships).

Lands acquired are valuable for public access, watershed protection, wildlife habitat, recreation, open space, and scenic resources. Administrative complexes costly to maintain and manage (with a backlog of deferred maintenance) or National Forest System lands encumbered by long-term land occupancy commitments and authorizations that have lost their national forest character and provide minimal benefit to the public have been disposed of through land ownership adjustments.

Road and trail right-of-way easements have been acquired to maintain the integrity of forest resources and provide public access to National Forest System lands for all existing or proposed

road or trail alignments through non-Federal lands (state, county, private, and other ownerships; refer to the “Public Access” section on page 72).

Property lines between National Forest System and non-Federal lands (state, county, private, and other ownerships) and boundary lines of special areas, such as the National Wilderness Preservation System, are easily identified and recognized by public land users, private landowners, and Forest Service personnel.

Existing National Forest System unit boundaries have been modified to provide national forest status to lands acquired, or lands to be acquired from non-Federal (state, county, private, and other ownerships) landowners, located outside unit boundaries, to provide logical exterior unit boundaries, and facilitate current and future management and administration of the Coronado National Forest.

An interconnected network of undeveloped open space within and adjacent to the national forest provides opportunities for legal public access and corridors for wildlife movement and supports healthy ecosystems.

## Guidelines

### *Land Exchanges*

1. Land exchanges should result in an improved land ownership pattern, more effective management of National Forest System lands, and foster sound community development.
2. Land exchanges should not result in the creation of isolated National Forest System parcels surrounded by non-Federal lands or isolated non-Federal parcels surrounded by National Forest System lands, unless it is found to be a public benefit.
3. The non-Federal lands considered for exchange into Federal ownership should meet one or more of the following criteria:
    a. Lands that provide needed public and administrative access, protect public lands from fire or trespass, or prevent damage to Coronado resources.
    b. Lands that contain vital threatened and endangered species habitat or vital wildlife habitat.
    c. Lands providing services to the public (such as developed and dispersed recreation or open space).
    d. Wetlands, riparian areas, and other water-oriented lands.
    e. Lands that contain unique, natural, or cultural values.
    f. Lands within designated wilderness.
    g. Lands that will improve public land management, meet specific administrative needs, or benefit other national forest programs.
    h. Lands that meet programs prescribed or endorsed by acts or reports of Congress or the Department of Agriculture.
4. Federal lands offered by the United States in a proposed land exchange should meet one or more of the following criteria:
    a. Lands needed to meet the needs of communities and the public.
    b. Lands that provide improved public land management.

c. Lands that will improve management, benefit specific resources, or increase management efficiency.

d. Lands that have lost their wildland characteristics.

e. Lands with long-term land occupancy commitments, high management and operating costs, do not contribute significantly to achieving management objectives, have minimal benefit to the public, and would not create an isolated non-Federal parcel surrounded by National Forest System lands such as, but not limited to, recreation residence areas and administrative sites.

*Landline Location*

1. Landline location surveys should be prioritized by the following criteria:

   a. Where known litigation is pending, a title claim has been asserted, encroachments are suspected, or the probability of encroachment can be reduced.

   b. Where significant resource values exist and use or manipulation of resources is planned (this includes the location, by survey, of right-of-way easements necessary for resource management).

   c. All remaining property lines.

2. A Bureau of Land Management (BLM) resurvey should be requested where there has been an extensive loss or obliteration of original corner monuments and/or where the potential for future litigation regarding the property boundaries between the national forest and private lands are high.

3. Painting and excessive clearing of property lines should be avoided.

*Locatable Mineral Withdrawals*

1. When recommending a new withdrawal or renewing an existing withdrawal, alternative protection opportunities such as the issuance of a right-of-way under Title V of the Federal Land Policy and Management Act or notation in the public land records should be explored and sufficient analysis, justification, and determination of need provided.

## Management Approaches

*Landline Location*

1. Minimizing future encroachment cases and resolving present encroachments should be considered a priority.

2. Considering opportunities to resolve boundary issues permanently at a substantial cost savings by consolidating non-Federal (State trust, county, private, and other ownerships) and National Forest System lands through the land adjustment program.

3. Acting on cooperative and joint land surveying opportunities with adjoining non-Federal land owners (State trust, county, private, and other ownerships).

*Land Ownership Adjustments*

1. Consolidating the National Forest System land ownership pattern through exchange, purchase, or donation, and other land ownership adjustment authorities.

2. Acquiring non-Federal lands or interest in lands from non-Federal land owners (state, county, private, and others ownerships) that resolve public access issues, contain vital threatened and

endangered species habitat or vital wildlife habitat, are water oriented and/or provide additional public recreational opportunities.

### Land Exchanges

1. Considering opportunities to consolidate small private land inholdings into economically viable units.[32]
2. Evaluating the Federal lands to determine the merits of exchanging them into non-Federal ownership.

### Rights-of-way

1. Ensuring administrative and public access to National Forest System lands by acquiring road and trail rights-of-way needed to meet public access objectives using various acquisition methods. Priority for road and trail rights-of-way acquisitions should be as follows:
    a. Public access to National Forest System lands.
    b. Administrative access to National Forest System lands.

### Boundary Modification

1. Recommending modification of the existing proclaimed national forest boundary to:
    a. Provide national forest status to acquire lands located outside the proclaimed boundary or to facilitate potential land ownership adjustments with landowners (state, county, private, and other ownerships) and land management agencies.
    b. Provide logical exterior boundaries and facilitate current and future management and administration of the Coronado National Forest.

### Open Space

1. Working with willing landowners, communities, local governments, and partners to promote voluntary open space conservation. Participating in local planning efforts regarding development or use of non-Federal lands as an information provider to help promote appropriate open space, access and recreation opportunities as well as to reduce ecological impacts and wildfire risks for communities.

### Locatable Mineral Withdrawals

1. Requesting new withdrawals and the extension or continuation of a needed existing withdrawal when necessary to:
    a. Preserve a unique resource area where no reasonable alternative to a withdrawal will provide adequate protection and the area will not survive without undue damage or impacts caused by mineral development. Examples of unique resource areas are research and experimental areas, botanical and zoological areas, cultural, historical, and archaeological areas, paleontological and geological areas, and other areas with special characteristics or unique values.
    b. Protect high value Federal improvements where relocation or replacement is impractical. Impractical means there would be an added cost or inconvenience to the Forest Service

[32] Economically viable units refer to a more efficient way to manage assets where the revenue is sufficient to fund and sustain itself.

that could not be adequately compensated for in a plan of operations, drilling permit, or lease.

c. Recommend the continuation of withdrawals at least 3 years prior to an existing mineral withdrawal's expiration date.

d. Recommend revoking withdrawals that no longer serve the purpose for which they were withdrawn or lack sufficient justification of need.

# Chapter 3. Management Areas

## Introduction

This chapter describes management areas, which are areas that have similar management intent and a common management strategy. The plan decisions and other content are described for each management area. See chapter 1 for descriptions of plan decisions and other content. This direction does not substitute for or repeat direction that applies to the entire national forest. The management areas described in this chapter occur in more than one place on the Coronado. They include land use zones, designated wilderness areas, wilderness study areas, recommended wilderness area, and eligible wild and scenic rivers, research natural areas, botanical, zoological, and other special areas.

Throughout this chapter, forest plan decisions (desired conditions, objectives, standards, and guidelines) are displayed within gray borders. Text outside of these gray borders are not plan decisions; such text consists of other plan content such as general descriptions, background material, explanations, and descriptions of management approaches.

In the event that a plan decision in this section and the plan decision in another section conflict, a project- or activity-level evaluation may be required to resolve the conflict; but generally the more restrictive plan decision prevails. Plan decisions and other content for forestwide management (chapter 2), geographic areas (chapter 4), and suitability (chapter 5) should also be consulted.

## Land Use Zones

Land use zones were developed by the Coronado National Forest as a way to more successfully manage the lands that fall outside of federally designated land and national processes, such as wilderness areas and research natural areas. They were generated to encompass multiple strategies and resources all in one cohesive and comprehensive system.

There are four land use zones on the Coronado National Forest: wild backcountry, roaded backcountry, developed recreation, and motorized recreation. See table 2 and “Geographic Areas” (on page 127 of chapter 4) for more details about ecosystem management areas and how the land use zones were distributed throughout the national forest.

**Table 2. Proposed ecosystem management area acreages of land use zones and management areas**

| Ecosystem Management Area (EMA) | Developed Recreation Land Use Zone | Motorized Recreation Land Use Zone | Roaded Back-country Land Use Zone | Wild Back-country Land Use Zone | Wilderness Areas | Wilderness Study Areas | Recommended Wilderness | Special Management Areas | Total Acres | Reference Map Location |
|---|---|---|---|---|---|---|---|---|---|---|
| Chiricahua | 4,623 | 0 | 81,155 | 79,630 | 87,169 | 0 | 31,258 | 786 | 284,619 | Page 129 |
| Dragoon | 696 | 0 | 23,440 | 28,331 | 0 | 0 | 0 | 0 | 52,467 | Page 133 |
| Peloncillo | 0 | 0 | 22,988 | 30,936 | 0 | 31,225 | 0 | 0 | 85,149 | Page 135 |
| Santa Rita | 2,701 | 824 | 72,386 | 35,905 | 25,121 | 0 | 0 | 0 | 136,937 | Page 138 |
| Tumacacori | 1,616 | 0 | 124,937 | 66,853 | 7,523 | 0 | 0 | 0 | 200,929 | Page 142 |
| Huachuca | 3,789 | 619 | 170,629 | 57,458 | 20,238 | 0 | 0 | 631 | 253,364 | Page 146 |
| Whetstone | 0 | 0 | 12,178 | 15,889 | 0 | 0 | 16,317 | 0 | 44,384 | Page 150 |
| Galiuro | 0 | 0 | 20,139 | 36,183 | 77,529 | 0 | 0 | 0 | 133,851 | Page 152 |
| Pinaleño | 8,187 | 883 | 25,584 | 98,954 | 0 | 61,315* | 61,315* | 3,278 | 198,201* | Page 154 |
| Santa Teresa | 0 | 0 | 4,225 | 17,786 | 26,891 | 0 | 0 | 0 | 48,902 | Page 158 |
| Winchester | 0 | 0 | 2,612 | 16,325 | 0 | 0 | 0 | 0 | 18,937 | Page 160 |
| Santa Catalina | 15,654 | 2,537 | 35,224 | 111,877 | 93,847 | 0 | 0 | 1,057 | 260,194 | Page 162 |
| Total Acres** | 37,264 | 4,863 | 595,497 | 596,127 | 338,318 | 31,225 | 108,890 | 5,752 | 1,717,934** | |

* The Graham Wilderness Study Area (61,315 acres) in the Pinaleño EMA is a wilderness study area and a recommended wilderness. Therefore, this area is only counted once for total acres of the Pinaleño Ecosystem Management Area. This reflects the correct acreage under recommended wilderness to be accounted for under various management approaches.

**Due to rounding, total acres are slightly less than total acres of the Coronado National Forest. For more information on special management areas, refer to the "Research Natural Areas, Botanical, Zoological, and other Special Areas" section on page 122.

## Wild Backcountry

### General Description

The wild backcountry land use zone is managed to maintain natural features and landscapes with minimum infrastructure necessary to support a range of nonmotorized uses. Motorized access is available via primitive, infrequently maintained roads. It includes inventoried roadless areas, areas adjacent to wilderness, and other relatively pristine, sparsely roaded areas. This zone offers recreational opportunities in the primitive to semiprimitive recreation opportunity spectrum. This means settings can be primitive, with wilderness-like areas that are natural and provide many opportunities for nonmotorized recreation that include challenge and solitude. It also includes roadless areas that provide many dispersed nonmotorized recreation opportunities such as hiking, camping, and birdwatching, but are closer to roads and have more visitors than the most primitive settings. Additionally, this land use zone offers similar areas that are accessed by primitive roads or motorized trails and are used for a wide variety of activities, both recreational and other, including enjoyment of scenery, escape from the crowded areas, hunting, off-highway vehicle use, dispersed camping, hiking, horseback riding, mountain biking, mining, and cutting firewood. Generally, the only facilities in these areas are primitive roads and trails. This land use zone makes up 596,127 acres, or about 35 percent of the Coronado National Forest.

### Desired Conditions

The wild undeveloped character of these areas is preserved. Settings are natural, and the sights and sounds of motorized vehicles are infrequent along roads and nonexistent in unroaded areas. Crowds or other urban elements are not evident. Motorized access is available via a few primitive or high-clearance roads. Motorized vehicle access is allowed into limited areas. Dispersed camping sites are available to those who seek them, but they are used infrequently. Recreational impacts on the landscape are minimal. Vegetation within these sites is vigorous and quickly recovers from the impacts of camping activities. Opportunities for solitude and quiet recreation are readily found. Hunters enjoy a challenging and remote experience. Visitors are able to explore and discover remote portions of the Coronado via primitive backcountry motorized routes. Quiet experiences are available in this entire zone, with the exception of areas directly adjacent to the small number of access roads.

### Guidelines

1. Recreation opportunity spectrum classes in this land use zone should be primitive, semiprimitive nonmotorized, and semiprimitive motorized except in areas where the recreation setting is influenced by motorized access in adjacent land use zones or by private inholdings.
2. Temporary roads should be allowed only for administrative access, national security, Tribal needs, forest health projects, or fires, except in inventoried roadless areas.
3. New roads or motorized trails should be allowed only as needed to restore motorized public access to National Forest System land or for resource protection.
4. Scenic resources should be managed so that human activities are minimally visually evident, as per the Coronado National Forest scenic integrity objective map.
5. New utility structures and power lines should not be allowed.

### Management Approaches

1. Exploring opportunities for creating and preserving quiet recreation areas through vehicle class designations on specific roads (limiting use to vehicles that produce noise within a decibel range compatible with quiet recreation goals).
2. Removing roads and temporary facilities when they are no longer needed.

## Roaded Backcountry

### General Description

The roaded backcountry land use zone is managed for a balance of dispersed motorized, nonmotorized, and quiet recreation uses. The natural character and recreation settings are retained and development is limited. This zone offers a range of recreation opportunities. Remote areas are roadless, have no facilities other than trails, and are available only for nonmotorized recreation where encounters with other visitors are infrequent. This setting offers many opportunities for privacy and challenges to visitors' self-reliance and outdoor skills. The most accessible areas are near roads and contain settings that, while predominantly naturally appearing, show some evidence of resource modification and utilization. Road densities tend to be higher and roads are better than primitive. In these settings, the number of interactions between users may be moderate to high and evidence of other users can be prevalent. Self-reliance on outdoor skills is only of moderate importance with little opportunity for challenge and risk. Roaded backcountry makes up 595,497 acres, or about 35 percent, of the Coronado National Forest.

### Desired Conditions

Settings are natural and there are very few permanent facilities, except where needed for homeland security or to meet statutory requirements. Opportunities for quiet recreation exist both away from roads and along many less heavily used routes. Dispersed campsites are clean, and impacts from campers are minimal. National Forest System roads provide access to trailheads; remote, undeveloped camping areas; and occasionally developed recreation facilities or administrative sites. Most roads are unpaved. Forest visitors can enjoy semiprimitive motorized recreation and explore the backcountry in off-highway vehicles along designated roads or motorized trails. Recreation opportunity spectrum classes in this land use zone are semiprimitive nonmotorized, semiprimitive motorized, roaded modified, and roaded natural except where there are small, remote administrative sites, developed recreation sites, and permitted facilities.

### Guidelines

1. The level and type of development should be limited in order to protect the natural character inherent in this zone.
2. Managers should consider expanding the uses of existing facilities before proposing new facilities.
3. New roads may be constructed, reconstructed, or relocated for a variety of public and administrative uses and needs.
4. Scenic resources should be managed so that human activities are visually subordinate or blend into the landscape, as per the Coronado National Forest scenic integrity objective map.

5. New utility structures and power lines should be located within existing communications sites and utility corridors except as needed to meet statutory requirements, such as mining law or laws to protect public health and safety.

## Developed Recreation

### General Description

This land use zone includes the major of public access corridors into the Coronado National Forest. The roads in this zone are mostly paved and are popular sightseeing routes. In some cases, the main roads are designated as scenic byways. Visitors often spend the day in these areas, and destinations include campgrounds, picnic areas, vista points, visitor centers, and lakes. Organization camps and recreational residences are found in some areas. There are many popular trailheads in these areas, and hiking trails generally provide access to roaded backcountry and wild backcountry zones and wilderness areas. Utilitarian facilities such as communication sites and astrophysical facilities found in this area have limited or no public access and sometimes are considerably different in terms of setting from the surrounding landscape and public facilities. This land use zone covers 37,264 acres, or about 2 percent, of the Coronado National Forest.

### Desired Conditions

Facilities are in good condition and blend into the national forest setting.[33] Visitors can enjoy natural settings with a high level of comfort and safety. Roads are well maintained and accommodate all types of vehicles. Astrophysical facilities occupy a minimal area within this land use zone.

### Guidelines

1. Recreation opportunity spectrum classes in this land use zone should be roaded natural, roaded modified, rural, and urban unless conflicting with wilderness management or needed to support the larger forest setting.
2. As public facilities are constructed or renovated, they should be made more accessible to meet or exceed accessibility guidelines.
3. Scenic resources should be managed so that human activities are visually subordinate and blend into the landscape as much as possible, as per the Coronado National Forest scenic integrity objective map and recreation opportunity spectrum classes. Utilitarian facilities that would not meet this guideline because of their functional requirements should be mitigated to minimize their contrast with line, form, color, texture, and scale of the surrounding landscape and built environment.
4. New utility structures and power lines should not be allowed, and upgrades to existing overhead lines should be buried when replaced.
5. Livestock grazing should not be permitted within developed recreation zone sites, except where designated allotments overlap with recreation area boundaries or for the purposes of targeted grazing for vegetation management.

[33] Except for utilitarian facilities under special use permit that cannot fully mitigate scenery impacts because of their functional requirements.

### Management Approach

1. Managing these areas in accordance with guidance provided in existing and future plans (such as corridor management plans, recreation concept plans, and others).

## Motorized Recreation

### General Description

This land use zone is assigned to areas that have a high level of motorized use. Two different types of motorized use areas are included in this zone: highway corridors that cross Coronado National Forest lands (where vehicles are traveling at high speeds and most travelers are simply passing through the national forest) and off-highway vehicle corridors (where facilities for off-highway vehicle use are provided). This zone provides a wide variety of recreational experiences—including driving for pleasure—while mitigating effects of motorized use and minimizing conflicts with other users. This land use zone covers 4,863 acres, or less than 1 percent, of the Coronado National Forest.

### Desired Conditions

In highway corridors, forest visitors have opportunities for driving for pleasure. Visitors can enjoy natural settings beyond the roadway, and roads are paved, well maintained, and accommodate all types of vehicles. The sights and sounds of highway traffic are only incidentally apparent outside of these areas.

In off-highway vehicle (OHV) corridors, forest visitors can enjoy semiprimitive motorized recreation and explore in OHVs along designated roads and routes. Long distance loop routes exist that provide varying experiences for different vehicle classes. Separate motorized trails (such as single-track motorized trails for dirt bikes and all-terrain vehicles (ATVs)) exist to minimize conflicts among OHV types. Where nonmotorized trails traverse this land use zone, adequate signing and enforcement deters motorized use of these trails. OHV and ATV use is concentrated in defined areas that promote a high quality, motorized use experience. The sights and sounds associated with OHV use are only incidentally apparent outside of these areas. Recreation opportunity spectrum classes in this land use zone should be semiprimitive motorized, roaded natural, and rural.

### Guidelines

1. In OHV corridors, development of OHV facilities should protect natural resources and mitigate OHV impacts.
2. Scenic resources should be managed so that human activities are visually subordinate and blend into the landscape, as per the Coronado National Forest scenic integrity objective map.
3. Facilities determined to be obsolete or no longer needed should be removed if feasible, except for facilities with historical significance.

### Management Approach

1. Assisting other agencies with highway corridor maintenance.

## Designated Wilderness Areas

Eight designated wilderness areas totaling 338,318 acres comprise approximately 19 percent of the Coronado. Table 3 displays the size of the wilderness areas and geographic areas (hereafter referred to as ecosystem management areas) that each is located within (see chapter 4 for descriptions of ecosystem management areas).

Figure 4 on page 104 shows the locations of the wilderness areas on the Coronado National Forest. The acres in the chart below reflect the most current mapping and Geographic Information Systems data available. In the 1986 plan, the wilderness acres were calculated based on topographic maps and were an approximation of the area within the existing boundaries. All wilderness boundaries were carried forward from the 1986 plan to the current plan.

**Table 3. Designated wilderness areas**

| Wilderness Area | Acres | Ecosystem Management Area |
|---|---|---|
| Chiricahua Wilderness | 87,169 | Chiricahua |
| Galiuro Wilderness | 77,529 | Galiuro |
| Miller Peak Wilderness | 20,238 | Huachuca |
| Mount Wrightson Wilderness | 25,121 | Santa Rita |
| Pajarita Wilderness | 7,523 | Tumacacori |
| Pusch Ridge Wilderness | 56,919 | Santa Catalina |
| Rincon Mountain Wilderness | 36,928 | Santa Catalina |
| Santa Teresa Wilderness | 26,891 | Santa Teresa |
| TOTAL | 338,318 | |

## Plan Components for All Designated Wilderness Areas

### Wilderness Character

*Desired Conditions*

The ecological systems within wilderness areas across the Coronado National Forest vary naturally over time and space. Wilderness areas provide a wide variety of opportunities for exploration, solitude, natural risk, challenge, and primitive and unconfined recreation. Wild landscapes harbor the Coronado's richest concentration of quiet places, with the sights and sounds of humankind substantially unnoticeable. Developments (such as fences, structures, and water containment features) are rare; those that exist offer visitors a glimpse of past cultures and traditional land uses.

*Guidelines*

1. Wilderness character should be maintained or improved. This includes untrammeled, natural, and undeveloped qualities, as well as opportunities for solitude or primitive and unconfined recreation.
2. Restrictions on visitor freedom (such as closures, permit systems, area quotas) should only be used when less invasive measures have proven insufficient to meet management objectives.

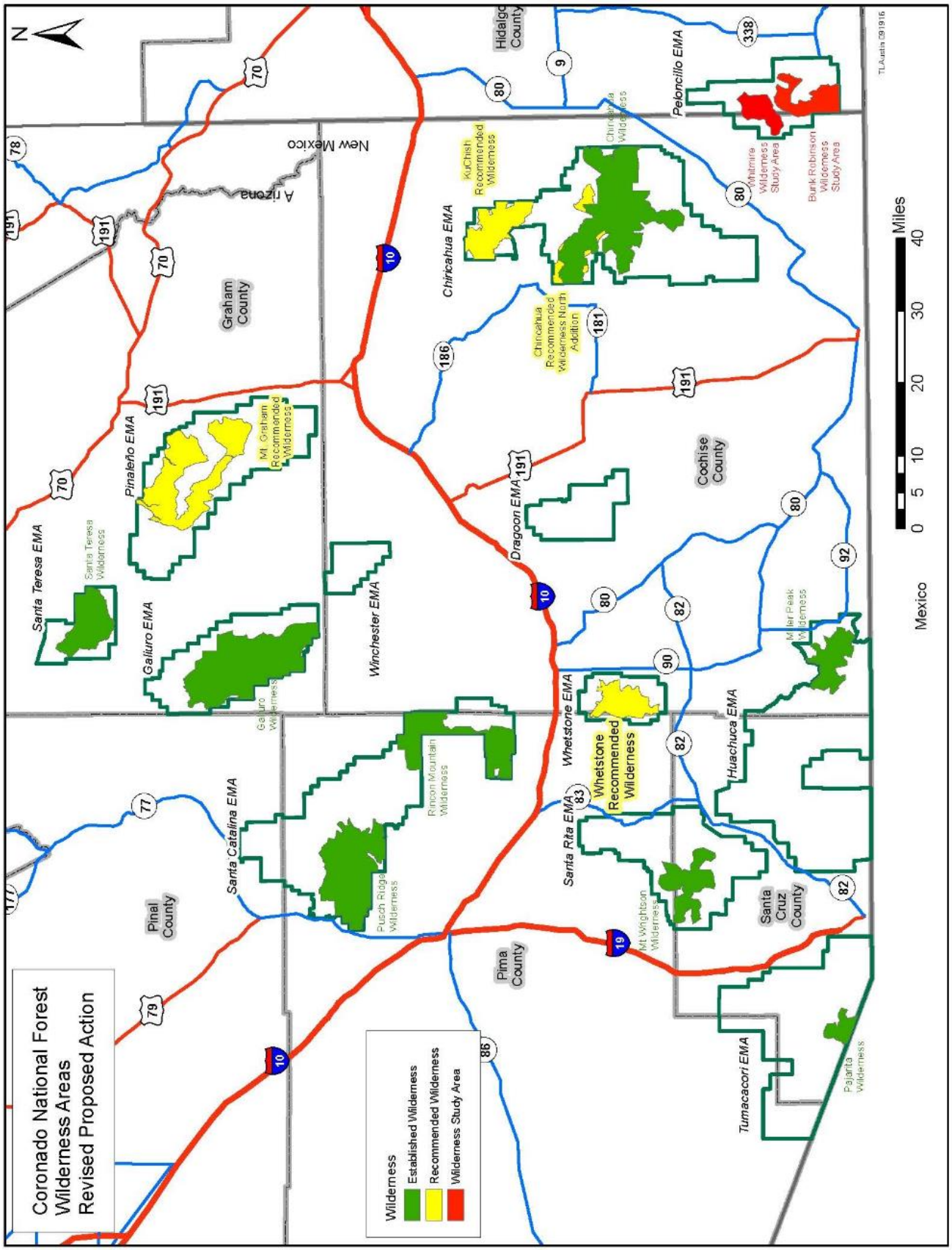


**Figure 4. Map of wilderness areas**

*Management Approach*

1. Completing and implementing wilderness management plans for each existing wilderness area.
2. Coordinating with local user groups to develop a volunteer wilderness stewardship program, emphasizing non-confrontational education and information sharing.

## Scenic Quality in Wilderness

*Desired Conditions*

Visitors find exceptional aesthetic value in wilderness areas across the Coronado. Scenic conditions are natural, unaltered, and wholly intact. Landscape character and sense of place are evident at the highest possible level.

*Standard*

1. Wilderness areas shall be managed for a scenic integrity objective of very high, except when specified otherwise in an individual wilderness management plan.

*Guidelines*

1. When trees or other materials are used for building trails, fences, signage, or other structures, materials should be harvested out of view from trails and campsites. Cutting or removing materials should not be evident.
2. Construction of additional structures should be limited in wilderness areas and should use a limited amount of nonnative materials when native materials are available.

## Vegetation in Wilderness

*Desired Conditions*

Vegetation communities in wilderness areas are consistent with those across the Coronado and represent native conditions for each type. Distribution, abundance, and diversity are sufficiently maintained through natural disturbance processes (such as fire, insects, or disease), and vegetation alterations are unnecessary to sustain communities. Invasive plants do not occur at levels that disrupt ecological functioning. Ecosystems that were once departed from a sustainable state have been restored to functioning systems that are resilient to a changing climate.

*Guidelines*

1. Vegetation treatments should only be used to restore or maintain communities to functioning systems that are sustainable and resilient under changing climate conditions and disturbance regimes.
2. Gathering of dead and downed fuelwood should be limited to recreational campfire use.

## Fire in Wilderness

*Desired Conditions*

Fire plays a natural ecological role in wilderness areas, acting as a disturbance that contributes to each area's natural character. Fire in wilderness areas varies in size and severity. Fires within an acceptable level of risk span into and across delineated wilderness boundaries. Fires rarely require physical human intervention, except in the wildland-urban interface. Wildfires do not threaten the natural characteristics of an area, nor do they threaten other resources, structures, or values at risk adjacent to wilderness areas.

*Guidelines*

1. Natural unplanned ignitions should be used to obtain resource benefits.
2. Prescribed fire should be used to create conditions that enable naturally occurring fires to return to their historic role or to achieve wilderness area desired conditions.
3. Minimum impact suppression tactics should be used in wilderness.

*Management Approach*

1. Consulting a wilderness resource advisor during all fires that enter or start within wilderness areas, and for any fires with the potential to enter wilderness areas or affect the character of an adjacent wilderness area.

## Insects and Disease in Wilderness

*Desired Conditions*

Indigenous insects and diseases are recognized as natural disturbance mechanisms in wilderness areas. The scientific value of observing the role of indigenous insects and diseases as a natural dynamic in the ecosystems is exceptionally high.

*Guideline*

1. Human controls should not be applied to insect and disease life cycles, except to protect resources on adjacent lands, to protect threatened and endangered species, or when human health and safety are a concern.

## Wildlife in Wilderness

*Desired Conditions*

Wilderness contributes to preserving the natural processes and habitats that sustain native species. Wildlife and fish populations in wilderness areas are thriving. Wilderness habitats are an important component of naturalness and are particularly valuable to threatened and endangered species, where the factors that threaten their existence are greatly minimized. Native species are present and supported by properly functioning habitat conditions. Human-wildlife interactions do not lead to wildlife habituation to human food sources.

*Standards*

1. Non-indigenous[34] species shall not be introduced into any wilderness area.
2. Reintroductions shall only occur when a species is determined to be indigenous to the area.

*Guideline*

1. Non-indigenous species should not be introduced into areas adjacent to wilderness areas when it is likely that individuals of that species will spread to wilderness areas during ordinary life processes.

*Management Approach*

1. Cooperating with State game management agencies as outlined in policies and guidelines for fish and wildlife management in wilderness.

## Soil and Water in Wilderness

*Desired Conditions*

Natural processes dominate soil and water cycles in wilderness areas. Water quality is high. Trails and campsites do not contribute soil sediment to downstream water resources.

*Standard*

1. Water quality measurements shall be made with temporary use of portable equipment. [35]

*Guideline*

1. Designated camping areas should be located on durable surfaces, and should be contained by using natural materials to create perimeter boundaries to prevent from increasing in size or compaction.

*Management Approach*

1. Working with local hiking and equestrian groups to maintain trails and to close and restore user-created trails.

## Recreation and Education in Wilderness

*Desired Conditions*

Educational materials on minimum-impact camping and travel skills and wilderness etiquette are available to visitors through the Coronado National Forest Web site, printed materials, trailhead information boards, personal contacts (both pre-trip and in the field), and other means. Once inside wilderness areas, there are no information boards and interpretation of the environment is primarily through self-discovery or facilitated in a group setting. Recreational structures (such as fire rings, improvised camp furniture) are temporary and easily dismantled. Recreational use does not result in the deposition of trash or other manmade items, or cause excessive noise or visual impacts that detract from the wilderness character. Outfitter-guide and recreation special use permit holders operate in compliance with their permit and do not negatively impact wilderness

[34] Determination of whether a species is indigenous will be made in consultation and coordination with State game management agencies.
[35] Transportable impermanent devices used to measure water quality parameters.

character. When traveling on trails, there is very low interaction between users; when traveling cross country, almost no human encounters occur.

*Standards*

1. The existing recreation opportunity spectrum classification composition shall be maintained at primitive, unless specified otherwise for an individual wilderness area.
2. Outfitter-guide operating plans shall include appropriate wilderness practices, such as “leave no trace” principles, and incorporate awareness for wilderness values in their interaction with clients and others.

*Management Approaches*

1. Completing visitor use estimates and capacity studies for each area if resource conditions are unacceptably impacted by permitted uses.
2. Adjusting group size if visitor use threatens the wilderness character.
3. Using education to prevent the unlawful collection of cultural artifacts.
4. Completing inventories of solitude, primitive, and unconfined recreation experiences.

## Trails and Signage in Wilderness

*Desired Conditions*

An interconnecting system of trails provides visitors with delineated access into, through, and out of wilderness areas, as well as to certain destinations within each area. Heavily used trails are well marked and maintained, while more remote trails offer a more primitive experience. Trails blend into the landscape and do not dominate the viewshed. User-created trails are rare. Signage is durable and easy to locate without dominating the natural backdrop. Trail and trailhead development emphasizes wilderness recreation and watershed condition while maintaining wilderness resource values. Visitors engage in primitive and unconfined recreation.

*Guidelines*

1. Trail maintenance should be coordinated to avoid anticipated high use visitor periods to minimize encounters.
2. New trail construction should only be considered if the objective is to enhance wilderness character (to control overuse or limit resource degradation).
3. Bridges should not be constructed or installed.
4. Signs within wilderness areas should provide directional information only, unless a specific need exists for an individual wilderness area.
5. Natural and preferably locally available materials should be used in the construction and signing of trails within wilderness areas, except when specified otherwise for an individual wilderness area.

*Management Approaches*

1. Prioritizing trail reconstruction based on potential for loss of wilderness values, impacts to wilderness recreation experience, access to wilderness, and amount of use.

2. Engaging hiking and equestrian groups in collaborative trail maintenance and construction projects and long-term partnerships.
3. Evaluating trails that are minimally used for their need and impact on wilderness character to support decisions to decommission unused trails.

### Land Ownership and Boundary Adjustment in Wilderness

*Desired Conditions*

Boundaries are posted and noticeable to visitors. The location of private lands within wilderness areas is identified.[36] Employees and visitors are educated about land owner rights. Wilderness character and experiences appear seamless across agency boundaries where Coronado wilderness areas border other agency wilderness areas.

#### *Management Approaches*

1. Communicating with landowners regularly to ensure that visitor-landowner conflicts are minimized.
2. Partnering with other Federal agencies to ensure management is as consistent as possible for contiguous wilderness areas.

### Research in Wilderness

*Desired Conditions*

Wilderness areas provide an ideal outdoor laboratory for studying the natural environment in its most pristine form. Scientific studies allow for discovery of wilderness dependent information. Research contributes to the understanding of complex ecosystem interactions and disturbances, and aids managers in improving wilderness management strategies. Field studies do not detract from wilderness character.

## Individual Wilderness Area Direction

All of the above desired conditions and plan components for general wilderness areas apply to each of the individual wilderness areas discussed below. The individual wilderness area direction is supplemental to the general wilderness desired conditions and plan components.

### Chiricahua Wilderness

#### *General Description*

At the heart of the Chiricahua Ecosystem Management Area lies the 87,169-acre Chiricahua Wilderness. This wilderness area was designated by the 1964 Wilderness Act and expanded by the 1984 Arizona Wilderness Act. More than a century ago, the Chiricahua Apache Tribe called the area of the Chiricahua Wilderness home. This mountainous landscape rises to an elevation of 9,797 feet at Chiricahua Peak. The Chiricahua Wilderness contains eight of the nine major vegetation communities.

[36] Private lands within wilderness areas were owned lands prior to the Wilderness Act of September 3, 1964, Section 5, Rights of Non-Forest Lands Ownership.

**Table 4. Major vegetation communities of the Chiricahua Wilderness**

| Vegetation Community | Percent of Chiricahua Wilderness |
|---|---|
| Madrean encinal woodland | 45.4 |
| Mixed conifer (wet and dry) | 19.4 |
| Madrean pine-oak woodland | 14.2 |
| Interior chaparral | 10.0 |
| Desert communities | 7.1 |
| Ponderosa pine-evergreen oak | 2.0 |
| Grasslands | 1.7 |
| Riparian areas | 0.3 |

The terrain of the Chiricahua Wilderness supports diverse plant life and populations of birds most often observed in Mexico. Dense brush, steep elevations, precipitous canyon walls, and an undependable water supply limit recreational use of the wilderness to the 13 established trails. Portions of Rucker Canyon, Turkey Creek, and Cave Creek are contained within the wilderness boundary. To the north, the Chiricahua National Monument Wilderness, managed by the National Park Service, augments the wilderness character of the mountain range.

*Desired Conditions*

Air quality is consistent with the area's class 1 Clean Air Act designation. The Cima Administrative Site and Monte Vista Cabin provide opportunities for wilderness education and historic preservation.

*Objective*

1. Remove trash along 4 miles of National Forest System trails annually during the first decade following plan approval.

*Standard*

1. The existing recreation opportunity spectrum classification shall be maintained at primitive.

*Guideline*

1. Trailhead parking areas, adjacent to the wilderness area, should be designed to passively limit visitor use to levels that maintain the wilderness character.

*Management Approaches*

1. Coordinating management strategies with Chiricahua National Monument Wilderness managed by the National Park Service.
2. Considering a permit system to facilitate pre-trip education, limit visitor use to a level compatible with wilderness values, and inform managers of the numbers, type, and spatial distribution of visitors in the Chiricahua Wilderness.
3. Integrating wilderness ethics education with information pertaining to wildlife-watching opportunities to limit adverse effects on wilderness character, particularly within the South Fork of Cave Creek and near the Rustler Park area.
4. Determining the capacity and need for outfitter and guide services within the Chiricahua Wilderness to meet increasing demand for special use permit requests.

5. Working with volunteer groups and educational organizations to preserve historic structures and restore degraded wilderness character where evidence of past human activities persist.

## Galiuro Wilderness

### *General Description*

Much of the Galiuro Ecosystem Management Area was designated as wilderness by the 1964 Wilderness Act. This 77,529-acre wilderness abuts the Bureau of Land Management administered Redfield Canyon Wilderness to the south. The highest elevation is 7,671 feet on Bassett Peak. The Galiuro Wilderness contains six of the nine major vegetation communities.

**Table 5. Major vegetation communities of the Galiuro Wilderness**

| Vegetation Community | Percent of Galiuro Wilderness |
|---|---|
| Madrean pine-oak woodland | 34.6 |
| Madrean encinal woodland | 26.1 |
| Interior chaparral | 20.6 |
| Mixed conifer (wet and dry) | 11.4 |
| Grasslands | 6.8 |
| Desert communities | 0.5 |

The Galiuro Wilderness preserves the primitive and wild character of the area for future generations. Within it, the precipitous, rocky, and brushy Galiuro Mountains rise abruptly in block-like uplifts from desert plains. At 19 miles in length and 6 miles in width (on average), these mountains are almost entirely within the designated wilderness. The area is characterized by many rugged cliffs displaying brightly colored rocks and exposed soils, the result of mostly wind-driven erosion. Bisected by two main canyons (Redfield and Rattlesnake), the Galiuro Wilderness supports vegetation that varies from semidesert grasslands; piñon, juniper, oak, and brush; and mixed conifers and aspens at high elevations. Lightly used trails traverse the ridges and valleys, accessing the few springs that provide the only sources of water in a range where there are no perennial streams.

### *Desired Conditions*

Air quality is consistent with the areas class 1 Clean Air Act designation. Powers Cabin provides opportunities for wilderness education and historic preservation.

### *Management Approaches*

1. Coordinating management strategies with the Redfield Canyon Wilderness managed by the Bureau of Land Management.
2. Working with volunteer groups and educational organizations to preserve historic structures and restore degraded wilderness character where evidence of past human activities persist.

## Miller Peak Wilderness

### *General Description*

Named for the highest point in the Huachuca Mountains, the Miller Peak Wilderness was established in 1984 by the Arizona Wilderness Act and encompasses 20,238 acres in the upper

elevations of the Huachuca Ecosystem Management Area. The Miller Peak Wilderness contains seven of the nine major vegetation communities.

**Table 6. Major vegetation communities of the Miller Peak Wilderness**

| Vegetation Community | Percent of Miller Peak Wilderness |
|---|---|
| Madrean encinal woodland | 51.4 |
| Mixed conifer (wet and dry) | 21.3 |
| Desert communities | 10.1 |
| Interior chaparral | 9.6 |
| Madrean pine-oak woodland | 4.9 |
| Grasslands | 2.6 |
| Riparian areas | 0.1 |

From atop 9,466-foot Miller Peak, the views extend into Mexico and across southeastern Arizona, with countless mountain ranges in all directions. The Arizona National Scenic Trail traverses the wilderness (and a major portion of the ecosystem management area) before reaching its southern terminus at the international border with Mexico. The Arizona National Scenic Trail and other trails crisscross slopes and ridgelines, navigating sheer cliffs and deep canyons, geographic features that collectively support over 170 species of birds, 78 species of mammals, and over 60 lizard species.

*Desired Conditions*

Historic structures are not damaged or destroyed by natural and human-caused disturbances.

*Objectives*

1. Annually remove trash along 5 miles of National Forest System trails within the Miller Peak Wilderness.
2. Restore 1 mile of user-created trails each year to a condition where it is not noticeable to visitors.

*Guideline*

1. Signs should be constructed from durable materials to sustain the impacts associated with the international border. In some cases, manmade materials for signs or signposts may be the most appropriate for this purpose, although natural-appearing materials suitable for a primitive recreation opportunity spectrum setting should be favored.

## Management Approaches

1. Coordinating with the U.S. Border Patrol and private landowners to develop strategies that ensure illegal immigrants and traffickers are not funneled into the Miller Peak Wilderness as enforcement activities ensue.
2. Working with volunteer groups, partners, and agency personnel to clean off-trail sites where discarded refuse from illegal immigrants has collected and degraded the wilderness character.
3. Communicating with U.S. Border Patrol officers to maximize safety awareness when large groups are present and during the high visitor use season.

4. Considering a permit system to reduce and contain visitor impacts.
5. Coordinating with the U.S. Border Patrol to ensure that agents are aware of wilderness policies and mindful of the wilderness characteristics unique to this area.
6. Making cautionary information related to the international border available at all trailheads.
7. Encouraging impact and restoration studies in this wilderness area.

## Mount Wrightson Wilderness

### *General Description*

The Mount Wrightson Wilderness was designated by the 1964 Wilderness Act. A focal point of the Santa Rita Mountains, the 25,121-acre Mount Wrightson Wilderness is characterized by rough hillsides, deep canyons, and lofty ridges topped by 9,452-foot Mount Wrightson. The Mount Wrightson Wilderness contains seven of the nine major vegetation communities.

**Table 7. Major vegetation communities of the Mount Wrightson Wilderness**

| Vegetation Community | Percent of Mount Wrightson Wilderness |
|---|---|
| Madrean encinal woodland | 46.8 |
| Madrean pine-oak woodland | 21.1 |
| Interior chaparral | 10.4 |
| Desert communities | 7.7 |
| Mixed conifer (wet and dry) | 7.6 |
| Grasslands | 5.1 |
| Riparian areas | 1.2 |

Ponderosa pine and Douglas-fir dominate higher reaches of the area, while lower and more exposed slopes are oak woodlands. Stream-fed canyons support an abundance of plant and animal life, including many montane Mexican plants that grow nowhere else north of the international border. This diversity that characterizes the Mount Wrightson Wilderness attracts nature enthusiasts who value wildlife viewing as vital to their wilderness experience. Madera Canyon offers world-renowned bird watching opportunities along trails within the wilderness.

*Objective*

1. Remove trash along 3 miles of National Forest System trails annually.

*Standard*

1. Wilderness areas within Madera Canyon shall be managed at the highest possible scenic integrity level, with a level of very high.

*Guidelines*

1. Trailhead parking areas should be designed to passively limit visitor use at levels that maintain the wilderness character.
2. The existing recreation opportunity spectrum classification composition should be maintained at semiprimitive nonmotorized, or increased to primitive.

### *Management Approaches*

1. Considering a permit system to facilitate pre-trip education, limit visitor use to a level compatible with wilderness values, and inform managers of the numbers, type, and spatial distribution of visitors in the Mount Wrightson Wilderness.
2. Encouraging the wilderness dependent research to include wilderness values and to limit adverse impacts into the wilderness resource.

## Pajarita Wilderness

### *General Description*

The 7,523-acre Pajarita Wilderness is in the Tumacacori Ecosystem Management Area and was designated in 1984 by the Arizona Wilderness Act. The Pajarita Wilderness contains five of the nine major vegetation communities.

**Table 8. Major vegetation communities of the Pajarita Wilderness**

| Vegetation Community | Percent of Pajarita Wilderness |
|---|---|
| Madrean encinal woodland | 38.0 |
| Desert communities | 36.4 |
| Grasslands | 23.5 |
| Riparian areas | 1.9 |
| Interior chaparral | 0.2 |

The Pajarita Wilderness encompasses a large portion of Sycamore Canyon, California Gulch, and the Goodding Research Natural Area. More than 660 species of plants have been identified within its borders, 17 of which are found nowhere else on Earth. Pajarita means “little bird” in Spanish, and more than 160 species of birds have been identified here along with more than 200 species of butterflies. Two major trails lead into the Pajarita Wilderness: Sycamore Canyon Trail runs south from Hank and Yank Spring, and the Border Trail skirts the international border from Summit Motorway, a rough four-wheel-drive road that parallels the eastern edge of the wilderness.

#### *Objective*

1. Remove trash along 1 mile of National Forest System trails annually within the Pajarita Wilderness.

#### *Guideline*

1. Signs should be constructed from durable materials to sustain the impacts associated with the international border. In some cases, manmade materials may be the most appropriate for this purpose, although natural appearing materials should be favored.

### *Management Approaches*

1. Coordinating with the U.S. Border Patrol to develop strategies that ensure illegal immigrants and traffickers are not funneled into the Pajarita Wilderness as enforcement activities ensue.
2. Working with volunteer groups, partners, and agency personnel to clean off-trail sites where discarded refuse from illegal immigrants has collected and impaired wilderness character, and to restore user-created trails.

3. Preventing buffelgrass outbreaks invasion into the wilderness by treating infestations outside of the wilderness boundary before they have a chance to spread into the wilderness.
4. Communicating with U.S. Border Patrol officers to maximize safety awareness when large groups are present and during the high visitor use season.
5. Considering a permit system to reduce and contain visitor impacts.
6. Coordinating with the U.S. Border Patrol to ensure that agents are aware of wilderness policies and mindful of the wilderness characteristics unique to this area. Further, working to ensure that actions taken by the U.S. Border Patrol are guided by the Forest Service's intent to maintain or improve wilderness values.
7. Making cautionary information related to the international border available at all trailheads.

## Pusch Ridge Wilderness

### *General Description*

Pusch Ridge is one of the most prominent geographic features of the Santa Catalina Mountains. It forms the backbone of the 56,919-acre Pusch Ridge Wilderness designated in 1978. The Pusch Ridge Wilderness contains seven of the nine major vegetation communities.

**Table 9. Major vegetation communities of the Pusch Ridge Wilderness**

| Vegetation Community | Percent of Pusch Ridge Wilderness |
|---|---|
| Madrean encinal woodland | 32.1 |
| Desert communities | 27.3 |
| Madrean pine-oak woodland | 19.8 |
| Grasslands | 11.3 |
| Interior chaparral | 5.8 |
| Mixed conifer (wet and dry) | 2.1 |
| Riparian areas | 1.6 |

Elevations range from 2,800 to 8,800 feet, creating a diverse biological community that extends from desert up to mixed conifer forest. Topography consists of razorback ridges, precipitous canyons, and mountaintops that support a few mountain meadows. The wildlife community inhabiting this varied setting is diverse as well. Black bear, coatimundi, Steller's jay, cactus wren, saguaro cactus, and Douglas-fir are all present in this wilderness. Finger Rock Canyon harbors a well-studied collection of xeroriparian vegetation, a common and important habitat type used by many species here and across the Coronado. The extensive trail network in Pusch Ridge and its proximity to a major metropolitan area make it the Coronado's most heavily visited wilderness area.

*Objective*

1. Annually, treat 200 to 1,000 acres of exotic invasive grass populations (primarily buffelgrass and fountain grass) on the southwest slopes of the Pusch Ridge Wilderness.

*Standards*

1. Wilderness areas near Sabino Canyon Recreation Area, Mount Lemmon communication sites, and along the General Hitchcock Highway shall be managed at the highest possible level, with a scenic integrity level of very high.
2. The existing recreation opportunity spectrum classification shall be maintained at semiprimitive nonmotorized in areas near heavily used trailheads and primitive elsewhere.
3. All areas treated for exotic invasive grass populations shall be monitored and re-treated as often as necessary to prevent reestablishment of the target invasive species.

*Guidelines*

1. Recreation facilities should not be developed in the Pusch Peak area.
2. Trailhead parking areas should be designed to passively limit visitor use at levels that maintain wilderness character.
3. Natural appearing materials suitable for a primitive recreation opportunity spectrum setting should be favored. Manmade materials should only be used in the construction and signing of trails when natural materials cannot be obtained at, or transported to, the site.
4. Cross-country travel should be discouraged to limit impacts to vegetation, soils, water, and wildlife.

*Management Approaches*

1. Considering a permit system to facilitate pre-trip education, limit visitor use to a level compatible with wilderness values, and inform managers of the numbers, type, and spatial distribution of visitors in the Pusch Ridge Wilderness.
2. Encouraging wilderness dependent research to include wilderness values and to limit adverse impacts to the wilderness resources.
3. Using the most effective combination of treatments available for invasive species containment and eradication to maximize effectiveness and minimize the amount of time required for management intervention.
4. Maintaining favorable habitat conditions for bighorn sheep within the entire wilderness area, and especially within the Bighorn Sheep Special Management Area (see page 163 for more information).
5. Supporting enforcement of restrictions on dogs, domestic sheep, and domestic goats in the Bighorn Sheep Special Management Area within the wilderness area.

## Rincon Mountain Wilderness

### General Description

The Rincon Mountain Wilderness was designated in 1984 at the southeastern edge of the Santa Catalina Ecosystem Management Area. This wilderness area spans 36,926 acres along the national forest boundary, and the highest elevation is 7,325 feet. The Rincon Mountain Wilderness contains six of the nine major vegetation communities.

The Rincon Mountain Wilderness is contiguous with the larger Saguaro Wilderness, which is administered by the National Park Service as part of Saguaro National Park-East. There are a few rough four-wheel-drive roads leading to the northern boundary and some trails leading into it from the national park. The Rincon Mountain Wilderness is accessible primarily by a single two-wheel-drive road (National Forest System Road 35) along its eastern boundary.

**Table 10. Major vegetation communities of the Rincon Mountain Wilderness**

| Vegetation Community | Percent of Rincon Mountain Wilderness |
|---|---|
| Madrean encinal woodland | 38.7 |
| Grasslands | 26.7 |
| Desert communities | 25.5 |
| Interior chaparral | 6.6 |
| Madrean pine-oak woodland | 2.1 |
| Riparian areas | 0.4 |

### Guideline

1. Trailhead parking areas should be designed to prevent motorized trespass beyond the wilderness boundary.

### Management Approaches

1. Coordinating management strategies with the Saguaro Wilderness managed by the National Park Service.
2. Encouraging visitors to limit off-trail group size (including cross-country travel and at dispersed camping areas) to no more than six people and six riding/pack stock animals per group.

## Santa Teresa Wilderness

### General Description

The 26,891-acre Santa Teresa Wilderness covers just over half of the Santa Teresa Ecosystem Management Area; it was designated in 1984. Adjacent to the northeast boundary is the North Santa Teresa Wilderness, managed by the Bureau of Land Management. This is one of the more remote and lightly visited wilderness areas on the Coronado. Elevations rise to 7,481 feet on the summit of Cottonwood Peak. The Santa Teresa Mountain Wilderness contains six of the nine major vegetation communities.

Caves and alcoves have hollowed out eroded cliffs into picturesque formations. Thick chaparral vegetation covers the terrain with stands of ponderosa pine and Douglas-fir on the north flanks and the crest of Cottonwood Peak. Black bear coati, javelina, and mountain lion are present.

Several foot trails traverse the deep canyons and bald summits, but are lightly used and may be difficult to follow. The most frequent use of these trails is by ranchers during periodic livestock drives. Water is available year round at several springs.

**Table 11. Major vegetation communities of the Santa Teresa Wilderness**

| Vegetation Community | Percent of Santa Teresa Wilderness |
|---|---|
| Interior chaparral | 31.9 |
| Madrean encinal woodland | 30.0 |
| Madrean pine-oak woodland | 13.1 |
| Grasslands | 12.7 |
| Ponderosa pine-evergreen oak | 12.1 |
| Desert communities | 0.2 |

### *Management Approaches*

1. Coordinating management strategies with the North Santa Teresa Wilderness managed by the Bureau of Land Management.
2. Coordinating with the Bureau of Land Management and San Carlos Apache Tribe to maintain and improve access to wilderness trailheads.

## Recommended Wilderness Areas and Wilderness Study Areas

### General Descriptions

The proposed action includes four areas totaling 108,889 acres to be managed as recommended wilderness: Ku Chish, the Mount Graham Wilderness Study Area, Whetstone, and Chiricahua Addition North (Figure 4). Two other wilderness study areas on the Coronado are not being recommended for wilderness designation: Bunk Robinson and Whitmire Canyon Wilderness Study Areas. Both recommended wilderness and wilderness study areas are managed to maintain their wilderness character.

**Ku Chish Recommended Wilderness Area.** The 26,245-acre Ku Chish Recommended Wilderness Area is located at the north end of the Chiricahua Ecosystem Management Area. Approximately 22,450 acres (86 percent) of this area are in inventoried roadless area. This recommended wilderness area is adjacent to the Chiricahua National Monument Wilderness, which is managed by the National Park Service. Steep terrain and an undependable water supply limit recreational use mainly to the three established trails in the recommended wilderness area.

**Mount Graham Recommended Wilderness Area.** The 61,315-acre Mount Graham Wilderness Study Area circles the high peaks of the Pinaleño Ecosystem Management Area. This wilderness study area was designated as such by the Arizona Wilderness Act of 1984, and was recommended for formal wilderness designation in the 1986 “Coronado National Forest Land and Resource Management Plan.” This area was never established by Congress as a designated wilderness area; therefore, it currently maintains its wilderness study area status and management. The 61,315-acre Mount Graham Recommended Wilderness Area represents the wilderness study area with boundary adjustments that provide for increased manageability without diminishing wilderness character. The portions of the wilderness study area that are not included in the Mount Graham Recommended Wilderness Area will continue to be managed as a wilderness study area. The area is characterized by steep mountainsides and canyons. Because of the areas unusual shape, access

is most readily available from Swift Trail Parkway, in its interior, rather than from trailheads around the base of the ecosystem management area. One access point at the end of Marijilda Canyon Road (National Forest System Road 57) allows hikers to follow a rare, perennial drainage into the wilderness study area, a canyon believed to support the highest diversity of lizard species in the United States. The Mount Graham Wilderness Study Area occurs entirely within inventoried roadless area.

**Whetstone Recommended Wilderness Area.** The Whetstone Potential Wilderness Area encompasses 16,317 acres. This area is located in the Whetstone Mountain Range, which is part of the Sierra Vista Ranger District of the Coronado National Forest in southeastern Arizona. The Whetstone Potential Wilderness Area is overlapped by 13,619 acres of the Whetstone Inventoried Roadless Area, comprising 83 percent of the potential wilderness area.

**Chiricahua Addition North Recommended Wilderness Area.** The Chiricahua Addition North Potential Wilderness Area encompasses 5,012 acres. The area is located adjacent to the existing Chiricahua Wilderness. This area would be an expansion of the Chiricahua Wilderness that is now 87,169 acres, bringing the overall acres to 92,181 if designated. This area is located in the Chiricahua Mountains, which is part of the Douglas Ranger District of the Coronado National Forest in southeastern Arizona. The Chiricahua Addition North Potential Wilderness Area is overlapped by 1,624 acres of the Chiricahua Inventoried Roadless Area, comprising 32 percent of the potential wilderness area.

**Bunk Robinson and Whitmire Canyon Wilderness Study Areas.** The New Mexico Wilderness Act of 1980 created both the Bunk Robinson and Whitmire Canyon Wilderness Study Areas, which occupy a large portion of the Peloncillo Ecosystem Management Area. Each was enlarged with the Arizona Wilderness Act of 1984, for a total of 19,062 acres in the Bunk Robinson Wilderness Study Area and 12,163 acres in the Whitmire Canyon Wilderness Study Area. To allow for flexibility in managing wildlife habitat—and because their ecosystems are well represented in other Arizona wilderness areas—both wilderness study areas were recommended for nonwilderness designation in the 1986 forest plan. Until Congress makes a decision, Bunk Robinson and Whitmire Canyon Wilderness Study Areas will continue to be managed to maintain their existing wilderness character.

### Desired Conditions

Wilderness study areas and recommended wilderness are natural in appearance. They provide unconfined opportunities for exploration, solitude, natural risk, challenge, and primitive recreation. When traveling on trails, human encounters are generally limited; when traveling cross country, almost no human encounters are expected. There is little evidence of human developments or human activities. Ecological disturbance processes such as fire, insects, and disease are the primary factors affecting landscape patterns in wilderness study areas.

There is little or no evidence of camping activity, unauthorized trails, or trash. Where needed, outfitters and guides provide services to visitors seeking a wilderness experience. Visitor use is in balance with wilderness characteristics.

### Standard

1. Salable minerals extraction will not be allowed.

### Guidelines

1. Wilderness study areas and recommended wilderness areas should be managed to maintain and enhance their wilderness character, which includes scenic resources, primitive recreation settings and fish and wildlife habitats.
2. Wilderness study areas and recommended wilderness should be managed to preserve or enhance scenic resources.
3. Wilderness study areas and recommended wilderness should be managed for primitive recreation settings.
4. New recreation facilities other than trails should not be constructed.
5. Timber harvest should not be permitted.
6. Gathering of forest products for sale should not be permitted.
7. Mechanized or motorized trails should not be designated.
8. New roads should not be constructed.

## Eligible Wild, Scenic, and Recreational Rivers

### General Description

There are no designated wild, scenic, or recreational rivers on the Coronado National Forest. However, in 1993, all rivers on the Coronado National Forest were evaluated to determine their eligibility as wild, scenic, or recreational rivers. This evaluation resulted in 16 river segments being eligible for designation. In 2008, the 16 river segments were reevaluated and all were determined still to be eligible. These 16 segments will be managed to maintain their eligibility. Table 12 (next page) displays the potential classification and outstanding remarkable values for each eligible segment.

### Desired Conditions

These rivers exist in a free-flowing condition with a range of flows that provide optimum conditions for native fish and wildlife and scenic quality. Healthy and diverse stands of riparian vegetation thrive along the banks and flood plain, reflecting the potential of the river's habitats and maintaining the channel at a higher level of stability. Recovery of channel and habitat conditions following scouring floods is not hindered by management activities within the wild and scenic river corridor. The river corridor provides important consumptive and nonconsumptive wildlife use opportunities for visitors. The public is aware of these opportunities as well as species protection requirements. The public is aware of the importance of native fish and releases listed species when caught. Aquatic habitat is maintained in a condition with low substrate embeddedness, abundant aquatic food supply, and stable streambanks (see "Riparian Areas" on page 51 for more desired conditions).

**Table 12. Eligible wild, scenic, and recreational river segments**

| Eligible River Segment | Classification | Outstandingly Remarkable Values | Area (acres) | Length (miles) | Ecosystem Management Area |
|---|---|---|---|---|---|
| Ash Creek | Recreation | Scenic, recreation, wildlife, fish, historic, cultural, and ecological | 2,019 | 6.2 | Pinaleño |
| Grant Creek | Recreation | Scenic, recreation, wildlife, fish, historic, cultural, and ecological | 1,800 | 5.0 | Pinaleño |
| Lower Cañada del Oro | Recreation | Scenic, wildlife, fish, and historic | 1,329 | 3.4 | Santa Catalina |
| Lower Cave Creek | Recreation | Scenic, recreation, geologic, fish, wildlife, historic, cultural, ecological, and riparian | 2,329 | 7.0 | Chiricahua |
| Lower Romero Canyon | Recreation | Recreation, wildlife, fish, historic, and cultural | 728 | 2.2 | Santa Catalina |
| Lower Sabino Canyon | Recreation | Scenic, recreation, wildlife, fish, historic, and cultural | 1,094 | 3.2 | Santa Catalina |
| Cima (Winn Falls) Creek | Wild | Scenic, recreation, wildlife, historic, cultural, and riparian | 844 | 2.5 | Chiricahua |
| Upper Cañada del Oro | Wild | Scenic, wildlife, and fish | 2,060 | 6.0 | Santa Catalina |
| Upper Romero Canyon | Wild | Scenic, recreation, wildlife, fish, and cultural | 2,163 | 6.1 | Santa Catalina |
| Upper Sabino Canyon | Wild | Scenic, recreation, wildlife, historic, and cultural | 2,629 | 8.0 | Santa Catalina |
| Upper South Fork Cave Creek | Wild | Scenic, recreation, wildlife, fish, historic, and riparian | 2,227 | 6.2 | Chiricahua |
| Rucker Creek | Wild | Scenic, recreation, wildlife, fish, and geologic | 2,048 | 5.9 | Chiricahua |
| Lower South Fork Cave Creek | Scenic | Scenic, recreation, wildlife, fish, geologic, cultural, riparian, and ecological | 439 | 1.4 | Chiricahua |
| Post Creek | Scenic | Scenic, recreation, wildlife, fish, and cultural | 785 | 2.2 | Pinaleño |
| Redfield Canyon | Scenic | Scenic and wildlife | 2,159 | 9.1 | Galiuro |
| Sycamore River | Scenic | Scenic, recreation, wildlife, fish, historic, cultural, and ecological | 1,759 | 5.0 | Tumacacori |
| **Total Area and Length** | | | **26,412** | **79.4** | |

Wild rivers are free of impoundments and free flowing. The shoreline is essentially primitive with little or no evidence of human activity. The area is inaccessible except by trail and no developed recreation facilities exist. The water quality meets or exceeds State standards.

Scenic rivers are free of impoundments and free flowing. The shoreline is largely primitive and undeveloped, and there is no substantial evidence of human activity. Evidence of human activities generally diminishes over time. Roads may reach or bridge the river. Improvements that occur are minimally intrusive in the landscape.

Recreation rivers are generally readily accessible by road or trail. Encounters with people are expected and recreation opportunities vary depending on their compatibility with the outstandingly remarkable value of the eligible segment. Vegetation management is used to enhance recreation river values. Improvements (such as primitive roads, trails, bridges, fences, or signs) may dominate the landscape. Facilities are visually complementary with the landscape. Roads and trails provide access within the river corridor consistent with protection and enhancement of scenic, cultural/historic, wildlife, and fish outstandingly remarkable values, and protection of soil and water quality. The transportation system supports interpretation, recreation, and resource management activities.

### Standard

1. The conditions that support the classification and outstandingly remarkable values will be maintained when implementing projects.

## Research Natural Areas, Botanical, Zoological, and Other Special Areas

### General Description

Research natural areas and botanical and zoological areas are designated to ensure protection of specific biological and zoological communities. Research natural areas are areas that the Forest Service has designated to be permanently protected and maintained in natural condition, so they may serve as experimental research controls and monitoring sites for the particular ecosystem they represent and used for education.

There are six existing research natural areas on the Coronado National Forest: Pole Bridge, Goodding, Elgin, Goudy Canyon, Butterfly Peak, and Santa Catalina Research Natural Areas. The Pole Bridge, Santa Catalina, Goodding, and Goudy Canyon Research Natural Areas overlap with designated wilderness areas. The Coronado National Forest currently has three proposed research natural areas, two of which are expansions of existing research natural areas: Canelo, Goodding Extension, and Pole Bridge Extension. The Goodding and Pole Bridge Extensions overlap with designated wilderness areas. All three of these areas were proposed by the 1986 plan, but were never established. In the 1986 plan, it was proposed that the Santa Catalina Research Natural Area would be reduced from 4,040 acres to 634 acres, but this reduced area was never established.[37] The revised plan proposes one new research natural area—Finger Rock Canyon—which falls almost entirely within designated wilderness. All current and proposed research natural areas within existing wilderness areas will be managed in accordance with

[37] The 1986 plan states the Santa Catalina Research Natual Area will be reduced from 4,131 acres to 890 acres. Improved mapping technology shows that the existing Santa Catalina Research Natual Area is 4,040 acres and the proposed reduced area is 634 acres. The revised plan carries forward the identical proposed boundary reduction with the corrected acreages.

Agency policy on retaining wilderness character. Direction for research natural areas should be applied to both proposed and established research natural areas.

Botanical and zoological areas are designated for a special feature such as a rare plant or animal. There is one existing botanical area on the Coronado, Wild Chile Botanical Area, and one designated zoological area, Wet Canyon Talussnail Zoological Area. There are two existing zoological-botanical areas on the Coronado National Forest: Guadalupe Canyon and South Fork of Cave Creek. The revised plan recommends one proposed area, Cave Creek Canyon Birds of Prey Zoological-Botanical Area. Three other areas on the Coronado have special designations: Bighorn Sheep Management Area, Appleton-Whittell Research Ranch, and Mount Graham Astrophysical and Biological Research Area. Guadalupe Canyon is almost entirely contained within a wilderness study area. The Cave Creek Canyon Birds of Prey and the Bighorn Sheep Management Area overlap designated wilderness areas.

Table 13 on the next page displays the size and status of the research natural areas, botanical, zoological, and other special areas and the ecosystem management area that each is located within (see chapter 4 for descriptions of ecosystem management areas). The acres in the table reflect the most current mapping and GIS data available.

## Desired Conditions

All special areas are characterized by generally unmodified environments in which unique natural features are preserved. Each special area provides an example of one or more unique features within the Coronado National Forest. Scenic conditions are natural, unaltered, and wholly intact. Landscape character and sense of place are evident at the highest possible level. Research and monitoring activities do not disturb archaeological sites.

Research natural areas have excellent examples of the ecological features for which they were designated, with little evidence of human activity or disturbance. Visitor access and use occurs at environmentally acceptable levels to maintain the research values of the research natural area. Special use permits within these areas are inappropriate unless they are related to research for which the area is designated. Fire management mimics natural fire processes and is compatible with ongoing research.

Botanical areas protect the plants and plant communities for which they are designated. Plants and plant communities within these areas are resilient and are not negatively impacted by human activities. Nonmotorized recreation is allowed on a limited basis on designated trails to protect soil conditions and hydrologic flow. New trails are discouraged.

Zoological areas protect the unique wildlife and associated habitat for which they are designated. These areas contain unique or significant animals, animal groups, or animal communities, habitat, location, life history, ecology, environment, rarity, or other features.

## Standard

1. Salable minerals extraction will not be allowed.

**Table 13. Special management areas**

| Special Management Area | Type | Status | Acres | Ecosystem Management Area |
|---|---|---|---|---|
| Wild Chile | Botanical Area | Designated | 2,836 | Tumacacori Page 142 |
| Wet Canyon Talussnail | Zoological Area | Designated | 1,218 | Pinaleño Page 154 |
| South Fork of Cave Creek | Zoological-Botanical Area | Designated | 786 | Chiricahua Page 129 |
| Guadalupe Canyon | Zoological-Botanical Area | Designated | 3,436 | Peloncillo Page 135 |
| Cave Creek Canyon Birds of Prey | Zoological-Botanical Area | Proposed | 25,764 | Chiricahua Page 129 |
| Bighorn Sheep Management Area | Other | Designated | 21,184 | Santa Catalina Page 162 |
| Appleton-Whittell Research Ranch | Other | Designated | 1,746 | Huachuca Page 146 |
| Mount Graham Astrophysical and Biological Research Area | Other | Designated | 2,937 | Pinaleño Page 154 |
| Sabino Canyon Recreation Area | Other | Designated | 1,423 | Santa Catalina Page 162 |
| Elgin | Research Natural Area | Designated | 245 | Huachuca Page 146 |
| Goudy Canyon | Research Natural Area | Designated | 558 | Pinaleño Page 154 |
| Santa Catalina (proposed reduction from original 4,040 acres to 634) | Research Natural Area | Designated | 634 | Santa Catalina Page 162 |
| Goodding | Research Natural Area | Designated | 540 | Tumacacori Page 142 |
| Goodding Extension | Research Natural Area | Proposed | 1,673 | Tumacacori Page 142 |
| Butterfly Peak | Research Natural Area | Designated | 1,058 | Santa Catalina Page 162 |
| Pole Bridge | Research Natural Area | Designated | 460 | Chiricahua Page 129 |
| Pole Bridge Extension | Research Natural Area | Proposed | 122 | Chiricahua Page 129 |
| Finger Rock Canyon | Research Natural Area | Proposed | 1,103 | Santa Catalina Page 162 |
| Canelo | Research Natural Area | Proposed | 386 | Huachuca Page 146 |
| **Total Acres** | | | **68,109** | |

# Arizona National Scenic Trail

## General Description

The Arizona National Scenic Trail (Arizona Trail) is a nonmotorized, largely primitive trail that stretches over 800 miles across Arizona to connect deserts, mountains, forests, wilderness, canyons, historic sites, communities, and people. It passes through some of the most renowned landscapes in the State of Arizona and is the only national scenic trail in the State. The Arizona Trail showcases Arizona's diverse life zones and scenery, and is enjoyed by a wide variety of nonmotorized recreationists, including hikers, equestrians, mountain bicyclists, cross-country skiers, and others. Starting in the Coronado National Memorial on the border between the U.S. and Mexico, the Arizona Trail climbs and descends from one Coronado National Forest "sky island" to another. It traverses the Huachuca Mountains, Canelo Hills, Patagonia Mountains, Santa Rita Mountains, Rincon Valley, Rincon Mountains, and Santa Catalina Mountains. There are 144 miles of Arizona Trail on the Coronado National Forest. North of the Coronado, the Arizona Trail continues across rolling Sonoran Desert hills and mountains, crosses the Gila River, then winds through the Superstition Mountains and on to the Mogollon Rim and the forests of northern Arizona. It crosses the Grand Canyon on the South and North Kaibab Trails, then continues across the Kaibab Plateau to end at the Utah border next to the Vermillion Cliffs National Monument. About 70 percent of the trail lies on National Forest System land, but the Arizona Trail also crosses Bureau of Land Management, National Park Service, Arizona State Parks, Arizona State Trust Land, county, private, and municipal lands.

## Desired Conditions

The Arizona National Scenic Trail provides both short and long distance nonmotorized recreation opportunities in mainly remote and primitive settings representative of the dramatic natural landscapes and varied vegetation of Arizona. Along most of the trail, infrastructure and facilities are few and are constructed in such a way as to be compatible with the scenic, natural, historic, and cultural qualities for which the trail was established. In remote areas, the sights and sounds of roads, motorized trails, utility corridors, and other facilities are rarely encountered. Near towns and developed recreation facilities, the Arizona Trail may become a more accessible and highly developed route with access to amenities via connector trails. Recreation and other activities on or adjacent to the Arizona Trail do not negatively impact cultural and natural resources, scenic integrity, or the nonmotorized recreation experience. User conflicts are infrequent. Signage, while unobtrusive, is sufficient to help long-distance travelers find nearby developed sites, trailheads, recreation facilities, and drinking water sources. Trailheads are conveniently placed and, where equestrian use is common, sufficient parking space for vehicles pulling trailers exists.

## Guidelines

1. Management actions within ½ mile of the Arizona National Scenic Trail should not result in recreation setting changes from less to more developed unless for the purpose of constructing or improving trail access or trail related facilities
2. Permitted recreation special use authorizations should be managed to protect the desired recreation setting for a nonmotorized trail.
3. New road or motorized trail construction across or adjacent to the Arizona National Scenic Trail should be avoided unless needed for resource protection or to meet statutory requirements, such as mining law or laws to protect public health and safety.
4. Placement of new utility corridors and communication facilities should be avoided by choosing alternate locations or co-located with existing utility corridors and facilities.

5. Utility lines should be buried when feasible to mitigate visual impacts.
6. Forest health projects should be managed to minimize long-term visual impacts within and adjacent to the Arizona National Scenic Trail corridor.
7. Fire on or in the foreground of the Arizona National Scenic Trail should be managed using minimum impact suppression tactics, or other tactics appropriate for the protection of values and resources for which the trail was designated. [38]

## Management Approaches

1. Working with the Arizona Trail Association and adjacent landowners and agencies to maintain the trail corridor and the condition and natural character of the surrounding landscape.
2. Managing the Arizona National Scenic Trail and corridor consistent with the 1995 Arizona Trail Management Guide, where applicable, until the comprehensive management plan is completed.
3. Managing the Arizona National Scenic Trail and corridor consistent with the comprehensive management plan when completed.

[38] Jolly, D.F. 1993. Minimum impact suppression tactics guidelines for the northern region of U.S. Department of Agriculture Forest Service, Missoula, Montana.

# Chapter 4. Geographic Areas

## Introduction

This chapter describes management direction that applies to unique geographic areas called ecosystem management areas or EMAs. Twelve ecosystem management areas are defined here, based on the major mountain ranges that comprise the Coronado National Forest. There is a description of each ecosystem management area and one or more plan components, as well as recommended management approaches. This chapter also includes management direction for special areas within ecosystem management areas, such as research natural areas or zoological-botanical areas. The management direction described in this chapter applies to the identified geographic area, in addition to the forestwide and management area-specific direction described in chapters 2 and 3. This chapter is organized by grouping ecosystem management areas by ranger district (Douglas, Nogales, Sierra Vista, Safford, and Santa Catalina Ranger Districts). See figure 2 on page 3.

The plan decisions and other content are described for each ecosystem management area. See chapter 1 for descriptions of plan decisions and other content. This direction does not substitute for or repeat forestwide direction.

Throughout this chapter, plan decisions (desired conditions, objectives, standards, and guidelines) are displayed within gray borders. Text outside of these gray borders are not plan decisions; they consist of other plan content such as general descriptions, background material, explanations, or descriptions of management approaches.

In the event that a plan decision in this section and the plan decision in another section conflict, a project- or activity-level evaluation may be required to resolve the conflict; and the generally the more restrictive plan decision prevails. Plan decisions and other content for forestwide management (chapter 2), management areas (chapter 3), and suitability (chapter 5) should also be consulted.

## Douglas Ranger District

The Douglas Ranger District consists of three ecosystem management areas: Chiricahua, Dragoon, and Peloncillo. The Douglas Ranger District is the only district that extends into the State of New Mexico.

### Chiricahua Ecosystem Management Area

#### General Description

The Chiricahua Ecosystem Management Area includes 284,621 acres of National Forest System land, encompassing nearly all of the Chiricahua Mountains. Steep canyons with densely timbered slopes dissect the range, radiating in all directions from 9,797-foot Chiricahua Peak. The Barfoot, Long, and Rustler Parks are world renowned for uncommon bird and reptile species, including the largest known population of twin-spotted rattlesnakes. Rock formations are visible from many vantage points throughout the ecosystem management area. At the heart of the Chiricahua Ecosystem Management Area lies the 87,169-acre Chiricahua Wilderness and 5,012-acre Chiricahua Recommended Wilderness Addition; and at the north end lies the 26,245-acre Ku Chish Recommended Wilderness Area.

Several four-wheel-drive roads cross the Chiricahua Ecosystem Management Area at the northern and southern extents. A single two-wheel-drive accessible road crosses the range from east to

west over Onion Saddle, but it is usually closed in winter. Numerous developed sites have camping and picnicking facilities and all are accessible with a two-wheel-drive vehicle. Dispersed recreation areas are also available throughout the Chiricahua Ecosystem Management Area. In particular, the ridges and drainages surrounding Cochise Head (the single largest rock outcrop on the Coronado National Forest) remain rugged and remote with access limited primarily to on- and off-trail travel. West of this landmark, within the northern portion of the ecosystem management area, Chiricahua National Monument (managed by the National Park Service) is contiguous with the Coronado on three sides.

The Chiricahua Mountains, along with all the lands in the southeastern corner of Arizona, were once part of the Chiricahua Apache Reservation, and the mountains continue to be a special place for descendants of the Chiricahua Apaches. Many of these descendants now live in Oklahoma and New Mexico as part of the Mescalero and Chiricahua-Warm Springs-Fort Sill Apache Tribes, though the San Carlos Apache Tribe in Arizona also counts Chiricahua descendants among its members. Ancestors of members of the White Mountain and San Carlos Apache Tribes frequented the mountain ranges of the Douglas Ranger District, and Apache Scout camps were located in the Chiricahua Mountains in the 19th century. Today, members of the Mescalero Apache Tribe make trips to the Chiricahua Ecosystem Management Area to teach Tribal youth about their history and heritage.

**Pole Bridge Canyon Research Natural Area.** This 460-acre research natural area was established in 1931 to feature distinctive tree populations of the Mexican pine-oak ecosystem, particularly Apache pine, southwestern white pine, border piñon, and Arizona pine. An additional 122 acres have been proposed for inclusion as the Pole Bridge Canyon Research Natural Area Extension. The addition includes examples of two Chihuahua pine habitat types, Chihuahua pine/Arizona white oak and Chihuahua pine/silverleaf oak, providing a more complete representation of the Sierra Madrean pine-oak ecosystem within this research natural area. Both the Pole Bridge Canyon Research Natural Area and the proposed extension are encompassed by the Chiricahua Wilderness.

**South Fork of Cave Creek Zoological-Botanical Area.** Located in the eastern portion of the Chiricahua Ecosystem Management Area, the 786-acre South Fork of Cave Creek Zoological-Botanical Area was designated in the 1986 forest plan. This special area supports unique flora and fauna, including essential habitats for threatened and endangered plants and animals. The area is completed surrounded by the proposed Cave Creek Canyon Birds of Prey Zoological-Botanical Area and overlaps the Chiricahua Wilderness.

**Barfoot National Natural Landmark.** Designated in 2011, the 680-acre Barfoot Park provides one of the best Madrean-influenced ponderosa pine forests in the U.S. The site supports an unusually high amount of plant diversity and includes one of the largest concentrations of well-developed talus slopes in the region, supporting plants and animals not found elsewhere at the site.

**Proposed Cave Creek Canyon Birds of Prey Zoological-Botanical Area.** The 25,764-acre proposed Cave Creek Canyon Birds of Prey Zoological-Botanical Area is located in the eastern portion of the Chiricahua Ecosystem Management Area. This special area highlights a diverse assemblage of migratory and year-round wildlife, as well as the rare riparian setting that attracts these species. Recent research has found that Cave Creek Canyon harbors the densest known population of breeding raptors in the U.S. World-class birding is a highlight of the area. The proposed Cave Creek Canyon Birds of Prey Zoological-Botanical area completely surrounds the existing South Fork of Cave Creek Zoological-Botanical Area.

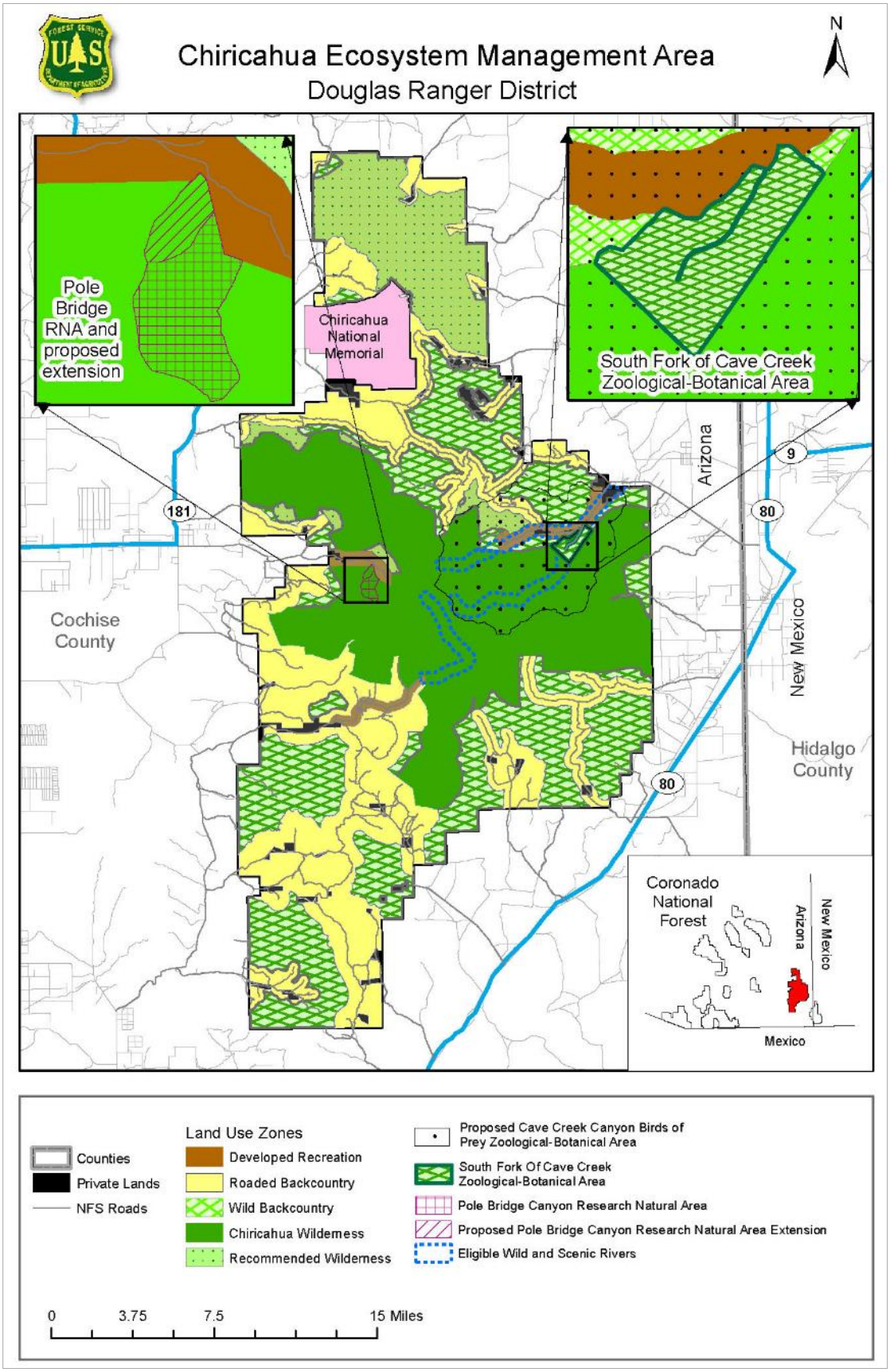


**Figure 5. Chiricahua Ecosystem Management Area land use zones and special areas**

### Desired Conditions

The Chiricahua Ecosystem Management Area offers a wide spectrum of developed recreation opportunities for a growing population, while large tracts of undeveloped areas remain available for primitive and dispersed recreation. The landscape has recovered from resource damage caused by illegal activities. Trash is not commonly found. Pinery Road over Onion Saddle provides a scenic driving experience and vehicular access to high elevations. Recreation facilities are sufficient in size and number to accommodate demand while supporting a high quality, outdoor experience. Administrative sites, such as Rucker, Pinery, Rustler Park, and Cima Administrative Sites, are in good condition and available as appropriate for Forest Service, Tribal, and public use as part of the "Rooms with a View" cabin rental program. Recreation residences and the organization camp blend well with the natural landscape and do not expand beyond their authorized footprint. Permanent legal public vehicular access to National Forest System lands within the ecosystem management area is established and is easily accessible by public land and administrative users. Watersheds provide high quality surface and ground water flows.

Cultural and historic properties (such as Camp Rucker, Rustler Park, Cima Cabin, Barfoot Lookout, and Monte Vista Lookout Cabin) retain integrity of setting, location, association, materials, design, workmanship, and feeling to provide the public and Forest Service employees a long-term perspective on the region's spirit, character, and identity, and to impart information about the past history of the mountain. Historic Apache scout camps have been identified and are protected in partnership with the White Mountain and San Carlos Apache Tribes. Archaeological sites of the Chiricahua Mountains provide Tribes, researchers, and the public with scientific data about, as well as tangible links to, the long and diverse history of southeastern Arizona. The Pole Bridge Canyon Research Natural Area and its proposed extension retain the characteristics of the Mexican pine-oak ecosystem, including populations of Apache pine, southwestern white pine, border piñon, and Arizona pine.

Descendants of the Chiricahua Apaches feel welcome in their traditional homeland and make use of campgrounds, dispersed camping areas, and administrative sites for cultural and educational events. Medicinal plants, wild plant foods, ceremonial plants, basketry materials, and other traditional resources are available for collection by Tribal members. Sites that have been identified as sacred or holy for the Chiricahua Apache are available to Chiricahua Apache descendants and members of the Fort Sill and Mescalero Apache Tribes for individual and group prayer, and traditional ceremonies and rituals.

High-elevation meadows are dominated by native grasses and grasslike plants and are relatively free of trees and shrubs. The wildlife and vegetation species in the area surrounding Barfoot Park are perpetuated. Elements of spruce-fir communities, including stands of Engelmann spruce, exist in the mixed conifer forests above 8,500 feet. Cave Creek Canyon supports a full cohort of native nesting birds, particularly cavity-nesting birds, and provides opportunities for world-class birding. Unique wildlife and vegetation species are perpetuated in the South Fork of Cave Creek Zoological-Botanical Area and the Pole Bridge Research Natural Area. The unique resources that provide habitat for the highest number of birds of prey in the U.S. are maintained or enhanced in the Cave Creek Canyon Birds of Prey Zoological-Botanical Area. Recreation activities and other uses do not degrade these values. Cave Creek and the South Fork of Cave Creek retain the characteristics required to be designated an "outstanding Arizona water" by the Arizona Department of Environmental Quality.

### Objective

1. Every 10 years treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 20 percent of the Chiricahua Ecosystem Management Area to create resiliency to disturbances. Treatments will be consistent with the objectives for forestwide vegetation communities and resources.

### Standards

1. Within the Pole Bridge Research Natural Area and Proposed Pole Bridge Research Natural Area Extension:
   a. Vegetation cutting is prohibited, including harvest of forest products and firewood.
   b. New roads or other improvements are prohibited; the use of existing roads and trails is allowed for fire management purposes.
   c. Camping is prohibited.
2. Within South Fork of Cave Creek Zoological-Botanical Area:
   a. A special use permit is required for any plant or animal collection.
   b. A special use permit is required for scientific research that would involve placing anything on National Forest System lands within the proposed zoological-botanical area.

### Guidelines

1. Cattle should be excluded from Camp Rucker to foster protection of the historic buildings and ruins.
2. During vegetation treatments, considerations of mesic microenvironments for woodland and talussnails endemic to the Chiricahua Ecosystem Management Area (such as trees near rocky features, islands of shrubs within talus slopes, riparian colluvia, large logs, and scattered rocks on shady hillsides) should be incorporated.
3. Management activities involving ground disturbance, vegetation management, or both should incorporate site-specific design features to benefit habitat for, or mitigate impacts to, rare or unique vertebrate, invertebrate and plant populations. For the Chiricahua Ecosystem Management Area, these species include, but are not limited to:
   - Chiricahua fleabane
   - Chiricahua gentian
   - copper mine milk-vetch
   - Hinkley’s Jacob's ladder
   - Porsild’s starwort
   - purple-spike coralroot
   - Rusby’s hawkweed
   - smooth baby-bonnets

### Management Approaches

1. Consulting with the Mescalero, Ft. Sill, San Carlos, and White Mountain Apache Tribes to develop stewardship plans for archaeological sites and other traditionally important places and to foster collaborative stewardship with Ft. Bowie. Establishing a memorandum of understanding between the Forest Service and Mescalero Apache Tribe to facilitate Tribal events in the Chiricahua Ecosystem Management Area.
2. Collaborating with Friends of Cave Creek Canyon.
3. Collaborating with the Southwest Research Station to facilitate the flow of scientific information that can be used to inform natural resource management.

## Dragoon Ecosystem Management Area

### General Description

The rugged Dragoon Ecosystem Management Area contains 52,467 acres of the Dragoon Mountains and adjoining semidesert grasslands and savannahs. Elevations range from 4,600 feet to the 7,519-foot Mount Glenn. The Dragoon Mountains, and specifically Cochise Stronghold (both East and West Stronghold Canyons), have long been recognized as a special place for the descendants of the Chiricahua Apaches (including Mescalero, San Carlos, and Chiricahua-Warm Springs-Fort Sill Apache Tribes). Members of the four southern Tribes collect basketry materials at the lower elevations of the Dragoons as their ancestors probably did centuries ago.

The natural fortress of Cochise Stronghold's granite domes and rock formations attracts rock climbers, photographers, wildlife viewers, and hikers from around the country. East Stronghold Canyon offers developed recreation opportunities while West Stronghold Canyon features a more dispersed recreational experience. The rugged terrain does not lend itself to additional road developments. The soils within this ecosystem management area are fragile and easily damaged by vehicles driving off roads. Access throughout much of the ecosystem management area is via unpaved roads.

### Desired Conditions

The Dragoon Ecosystem Management Area offers a wide spectrum of developed recreation opportunities for a growing population, while large tracts of undeveloped areas remain available for dispersed recreation. The unroaded core of the ecosystem management area is wild in character and opportunities for quiet recreation exist. Geologic features and rock formations that dominate the Dragoon Ecosystem Management Area provide outstanding rock climbing opportunities. Rock climbers and other visitors do not cause permanent resource damage and abide by restrictions needed for wildlife protection. Well-contained motorized dispersed campsites are available along the western edge of the ecosystem management area, and campers do not cause permanent damage to soils or vegetation. The East Stronghold Canyon area offers opportunities for safe developed recreation and interpretation of the history and ecology of the area. The number of miles of trails is sufficient to provide nonmotorized access, and users do not create unauthorized trails. The landscape has recovered from resource damage caused by illegal activities. Trash is not commonly found. Watersheds provide high quality surface and ground water flows.

Stands of Arizona cypress exist in the cool drainages on the east side of the Dragoon Ecosystem Management Area. An open savanna vegetation structure occurs along portions of the west flank of the Dragoon Ecosystem Management Area.

Permanent legal public vehicular access to National Forest System lands in the ecosystem management area is established and easily accessible by public and administrative users.

### Objective

1. Within 10 years of plan approval, treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 15 percent of the Dragoon Ecosystem Management Area to create resiliency to disturbances. Treatments will be consistent with the objectives for forestwide vegetation communities and resources.

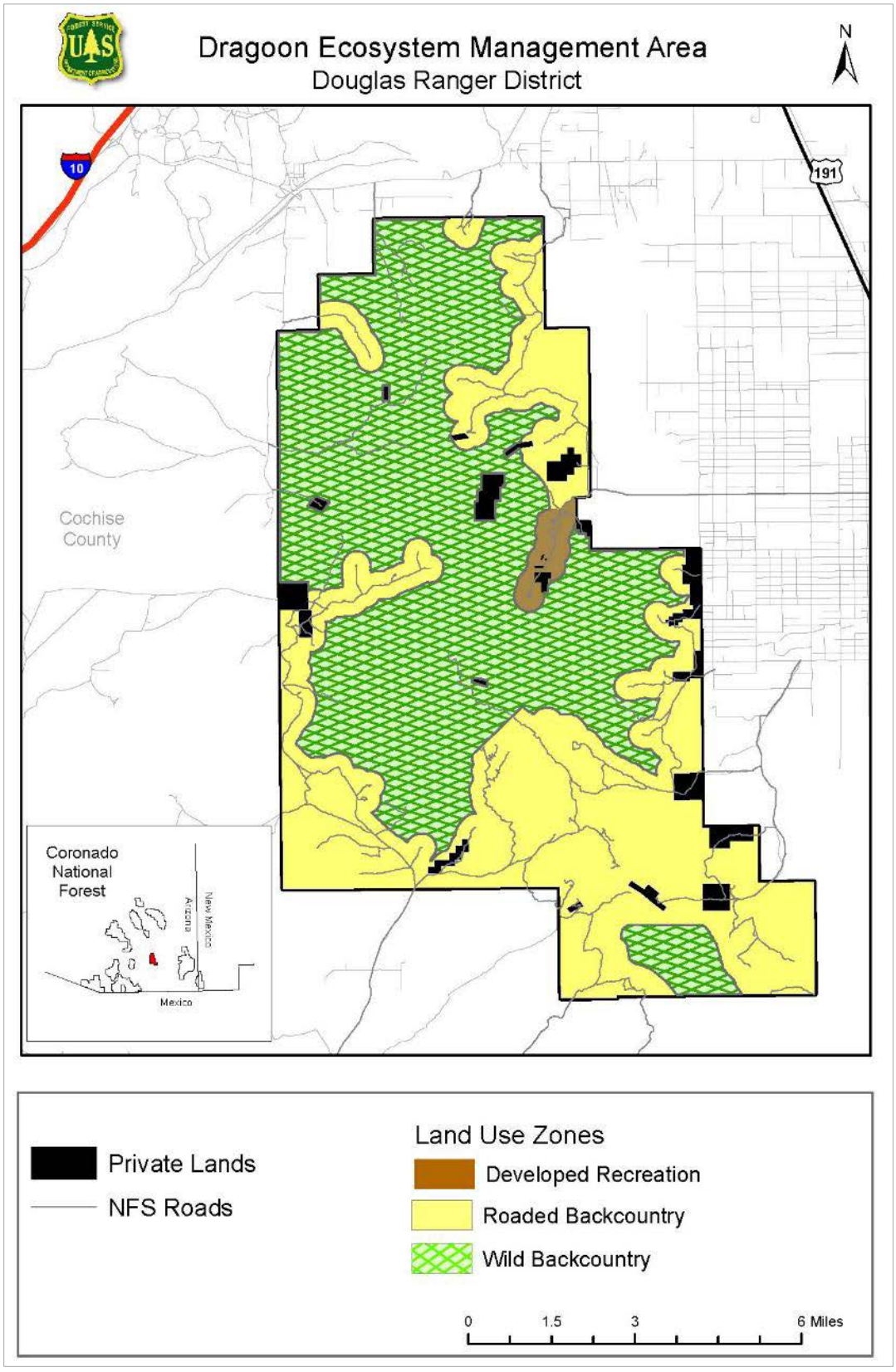


**Figure 6. Dragoon Ecosystem Management Area land use zones and special areas**

Guidelines

1. During vegetation treatments, considerations of mesic microenvironments for woodland and talussnails endemic to the Dragoon Ecosystem Management Area (such as trees near rocky features, islands of shrubs within talus slopes, riparian colluvia, large logs, and scattered rocks on shady hillsides) should be incorporated.
2. Areas disturbed by unauthorized motorized camping (outside of the defined dispersed camping areas) on the west side of the ecosystem management area should be revegetated and protected from new disturbance.
3. Management activities involving ground disturbance and/or vegetation management should incorporate site-specific design features to benefit habitat for, or mitigate impacts to, rare or unique vertebrate, invertebrate and plant populations. For the Dragoon Ecosystem Management Area, these species include, but are not limited to:
    - Coleman's coral-root and purple spike coral-root

## Peloncillo Ecosystem Management Area

### General Description

The Peloncillo Ecosystem Management Area is one of the most remote portions of the Coronado National Forest. Access is limited to primitive roads, primarily Geronimo Trail (National Forest System Road 63), and there are no developed recreation sites. Large unroaded areas are valued for their solitude and unconfined recreation opportunities. The relatively narrow range of elevation (from 4,593 to 6,624 feet) supports a surprising diversity of wildlife, most notably reptile and amphibian species.

Although mostly xeric, Cloverdale Cienega is one of the Peloncillo's rare aquatic features. The ecosystem management area's 85,149 acres straddle the Arizona-New Mexico border, with 81 percent in New Mexico. Situated southeast of the Chiricahua Mountains and just north of the U.S.–Mexico border, this southern portion of the Peloncillo range was occupied for millennia by farmers and foragers who had trading and cultural ties with neighboring groups, and was within the heartland of Chiricahua Apache territory. The 19,062-acre Bunk Robinson Wilderness Study Area and 12,163-acre Whitmire Canyon Wilderness Study Area flank Geronimo Trail to the south and north, respectively.

**Guadalupe Canyon Zoological Area.** This area was designated in the 1986 forest plan to protect 3,436 acres of habitat for unique wildlife associations. The area complements the Bureau of Land Management's outstanding natural area in lower Guadalupe Canyon, which is recognized for its exceptional birding habitat. The Guadalupe Canyon Zoological Area forms part of the Peloncillo Ecosystem Management Area's southern boundary and is almost entirely contained within the Bunk Robinson Wilderness Study Area.

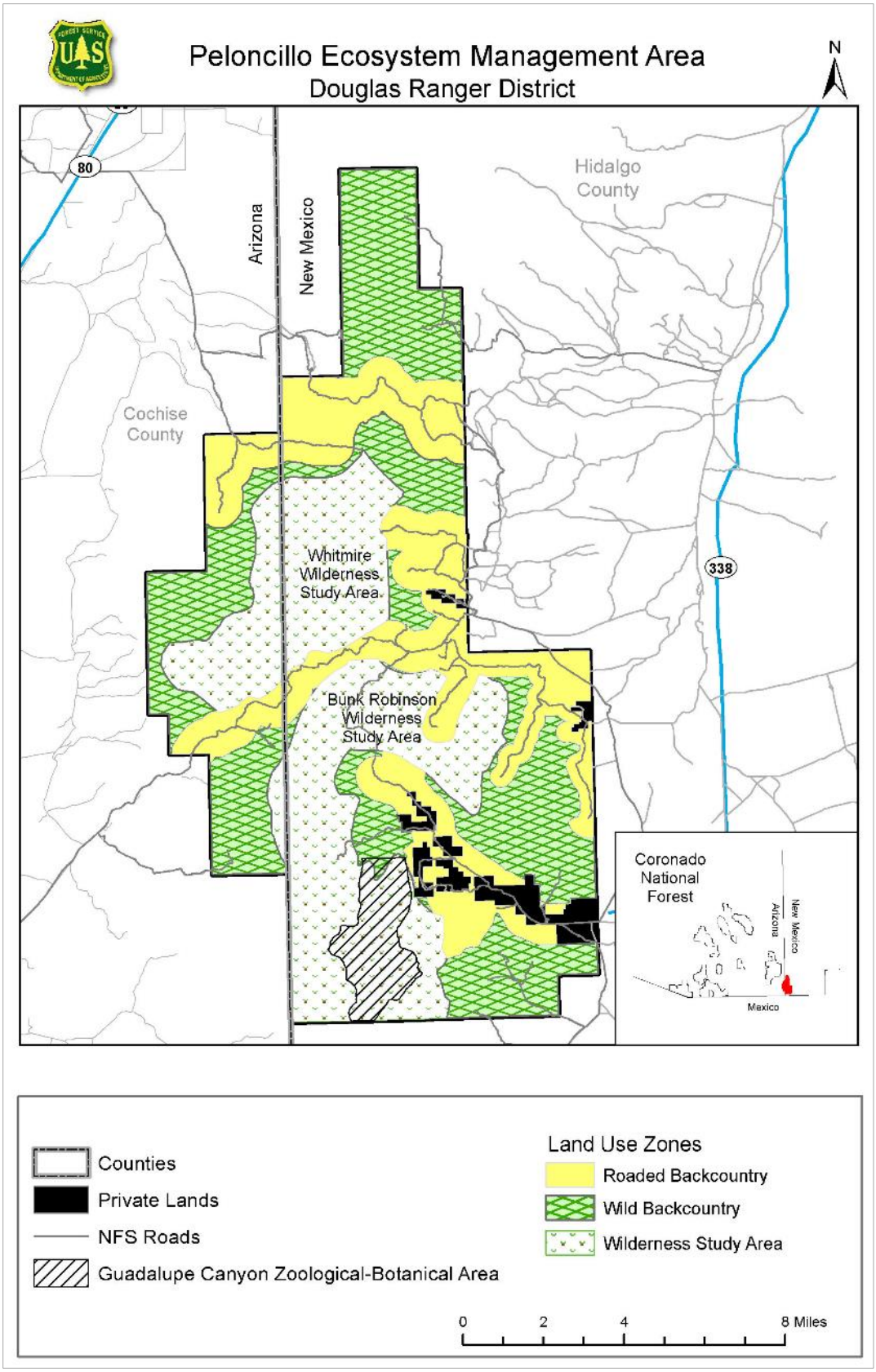


**Figure 7. Peloncillo Ecosystem Management Area land use zones and special areas**

### Desired Conditions

Recreation opportunities are primarily undeveloped, and the entire ecosystem management area is available for primitive and dispersed recreation. Geronimo Trail (National Forest System Road 63) provides opportunities for scenic driving and vehicular access through the ecosystem management area. The landscape has recovered from resource damage caused by illegal activities. Trash is not commonly found. Watersheds provide high quality surface and ground water flows.

The Cloverdale Cienega is dominated by perennial graminoid species such as spike rush, deergrass, and sedges. Flood flows, when they occur, are spread across the flood plain and not concentrated in channels. Unique wildlife species are perpetuated in the Guadalupe Canyon Zoological Area. Other uses do not degrade these unique values. Species that have historically moved freely between habitat in Mexico and within the Peloncillo Ecosystem Management Area continue to do so.

Permanent legal public access to the northern end and southeastern corner of the ecosystem management area is established, easily accessible by public land and administrative users, and interconnected to State, county, local public, and other Federal roads and trails. The complex land ownership patterns (checkerboard ownership) on the eastern (New Mexico) side of the ecosystem management area are consolidated into contiguous blocks of private land surrounded by National Forest System land and are easily identifiable and recognizable by public land users, private landowners, and Forest Service personnel. Permanent legal public vehicular access to National Forest System lands is established and is easily accessible by public land and administrative users in the Deer Creek, Starvation, and Skeleton Canyons, Whitmire and Deer Flat, Foster Draw and Black Mountains, Crescent and Cordy Cowen Tanks, and other areas within the ecosystem management area.

### Objective

1. Every 10 years treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 35 percent of the Peloncillo Ecosystem Management Area to create resiliency to disturbance. Treatments will be consistent with the objectives for forestwide vegetation communities and resources.

### Standards

1. Within Guadalupe Canyon Zoological-Botanical Area:
    a. A special use permit is required for any plant or animal collection.
    b. A special use permit should be issued for scientific research that would involve placing anything on National Forest System lands within the proposed zoological area.

### Guidelines

1. During vegetation treatments within Skull Canyon, considerations of mesic microenvironments for talussnails endemic to the Peloncillo Ecosystem Management Area (such as trees near rocky features, islands of shrubs within talus slopes, riparian colluvia, large logs, scattered rocks on shady hillsides) should be incorporated.
2. Management activities involving ground disturbance, vegetation management, or both should incorporate site-specific design features to benefit habitat for, or mitigate impacts to, rare or unique vertebrate, invertebrate and plant populations. For the Peloncillo Ecosystem Management Area, these species include, but are not limited to:
    - Chiricahua mudwort, copper milk-vetch, and New Mexico bitterweed

#### Management Approaches

1. Collaborating with the Malpai Borderlands Group.
2. Cooperate with other agencies to survey for Chiricahua mudwort.

## Nogales Ranger District

The Nogales Ranger District consists of two ecosystem management areas: Santa Rita and Tumacacori. This ranger district shares 29 miles of the international boundary with Mexico.

### Santa Rita Ecosystem Management Area

#### General Description

The Santa Rita Ecosystem Management Area takes its name from the mountain range it encompasses, the summit of which is 9,462-foot Mount Wrightson. Its distinctive pyramid-shaped profile rises above the surrounding savannas and deserts, visible from much of southeastern Arizona, and creates a striking backdrop for travelers along Interstate 10 and Highways 82 and 83. In 1985, these two state highways were designated “Patagonia-Sonoita Scenic Road” by the Arizona Department of Transportation. The 136,936-acre Santa Rita Ecosystem Management Area is visible from metropolitan Tucson and second only to the Santa Catalina Mountains in terms of recreational appeal. Madera Canyon, a popular birding area, offers developed recreation opportunities, including rental cabins at the Santa Rita Lodge and a gift shop. The east side of the ecosystem management area offers opportunities for off-highway vehicle use and dispersed recreation (such as camping, hunting, and foot trail based pursuits). An unmistakable geologic feature known as Elephant Head, at the ecosystem management area’s northwest extent, attracts backcountry rock climbers and serves as an attractive goal for cyclists along the Elephant Head Mountain Bike Route. The Arizona National Scenic Trail traverses the range from south to north. At the core of the Santa Rita Mountains is the 25,121-acre Mount Wrightson Wilderness.

The Santa Rita Ecosystem Management Area has a long history of human use prior to its development as a popular recreation area. Archaeological sites dating back thousands of years testify to hunting, farming, and plant collecting practices; members of the four southern Tribes, the San Carlos Apache Tribe and Pascua Yaqui, continue to visit the range to collect important traditional plants. The Santa Rita Mountains, or *Ce:wi Duag* (Long Mountain in O’odham), have been a recognized traditional cultural property as a place of continuing cultural importance to nearby Tribes. Extensive mining and ranching became prevalent in the late 19th century and continues at a smaller scale today.

Forest Service administration and Federal relief projects of the Great Depression are visible in old ranger residences and a Civilian Conservation Corps camp. A century-old partnership between the Forest Service and University of Arizona resulted in construction of the Florida Station, which serves as headquarters for the Santa Rita Experimental Range (managed by the University of Arizona College of Agriculture), located just beyond the northern boundary of the ecosystem management area. Another joint venture between the University of Arizona and Smithsonian Institution has placed a telescope and observatory at the top of the ecosystem management area’s second highest peak, Mount Hopkins, where research and public education continue today.

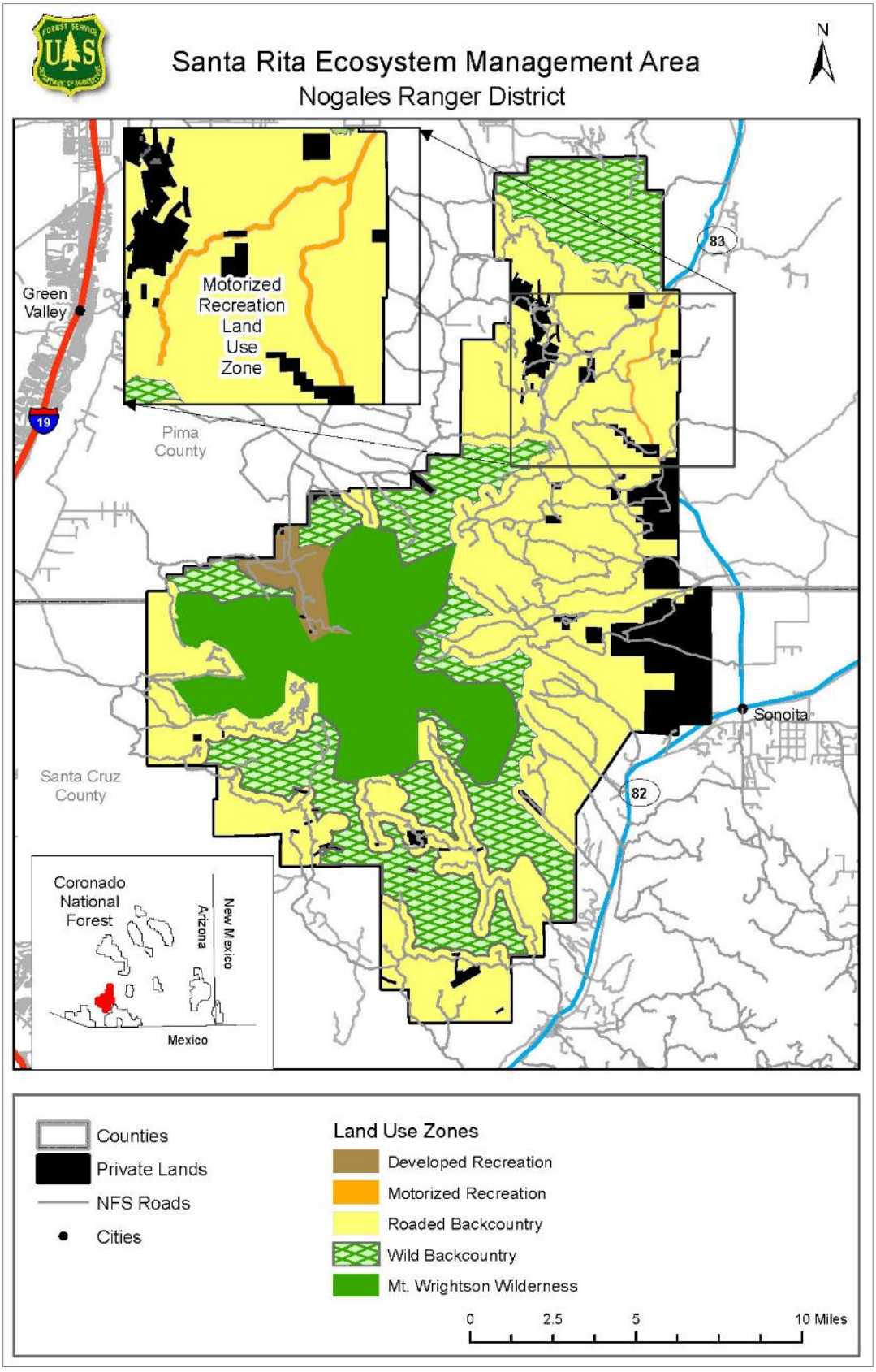


**Figure 8. Santa Rita Ecosystem Management Area land use zones and special areas**

**Onyx Cave National Natural Landmark.** In 1974, roughly 50 acres surrounding Onyx Cave were designated in recognition of the cave's numerous and beautifully developed shield formations within a series of passageways and rooms that honeycomb an outcropping of limestone. It is considered to be one of the finest caves in Ariona.

**Town of Patagonia Municipal Supply Watershed.** The 128,000-acre Sonoita Creek watershed is a municipal supply watershed. Sonoita Creek and its subterranean aquifer provides the only source of potable water for the town of Patagonia with over 900 residents and over 300 private well users within a 3-mile radius of town. The shallow depth of the aquifer, combined with the nature of the soils and underlying geology, make the relationship between the surface and ground water watersheds a particularly close and interconnected one.

### Desired Conditions

The Santa Rita Ecosystem Management Area offers a wide spectrum of developed recreation opportunities for a growing population, while large tracts of undeveloped areas remain available for primitive and dispersed recreation. In Madera Canyon, there are opportunities to camp in a developed recreation facility or in undeveloped campsites. Trailheads are well marked and lead to a network of well-maintained hiking trails. World-class bird watching opportunities exist along roads and trails. The Santa Rita Ecosystem Management Area offers an environment in which to recreate where risks are predominately natural and visitors do not feel threatened. The landscape has recovered from resource damage caused by illegal activities. Trash is not commonly found.

Kentucky Camp National Historic District is preserved and interpreted to provide the public with an understanding of the role mining and ranching has played in the development of southeastern Arizona. The Kent Springs Center and Kentucky Camp are available to the public and Tribes for a variety of recreational and educational experiences. Areas around Kentucky Camp and along the Greaterville Road continue to provide Tribes with places to collect traditional basketry materials and plant foods. The historic Florida Station is preserved, and its functionality as an environmental education center for youth and adults is expanded and enhanced, while continuing in the collaboration the station fosters.

The Santa Rita backcountry touring routes offer motorized and dispersed camping recreation opportunities. Elephant Head Mountain Bike Route offers a combination of lightly traveled roads and remote trails designed to both challenge a rider's skill and to provide a scenic, backcountry experience. The Arizona National Scenic Trail and Patagonia-Sonoita Scenic Road provide excellent opportunities to recreate and enjoy the scenery.

Water quality in Mansfield Canyon meets the State of Arizona's water quality standards. The Sonoita Creek watershed provides clean surface waterflows.

The dark skies above the Santa Rita Ecosystem Management Area present conditions conducive to astronomical research. The Smithsonian Mount Hopkins telescopes offer educational opportunities and promotes scientific discovery.

Outstanding split mineral interests (50 percent non-Federal/50 percent Federal ownership) have been acquired and consolidated into a contiguous block of subsurface Federal ownership affording more efficient management as well as greater protection of valuable natural resources and desired forest landscape conditions. The complex land ownership pattern (fragmented checkerboard ownership intermingled with irregular shaped parcels) within the ecosystem management area are consolidated into contiguous blocks of National Forest System and private land and are easily identifiable and recognizable by public land users, private landowners, and

Forest Service personnel. Legal status deficiencies of needed existing forest roads and trails systems have been resolved.

#### Objective

1. Every 10 years treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 20 percent of the Santa Rita Ecosystem Management Area to create resiliency to disturbances. Treatments will be consistent with the objectives for forestwide vegetation communities and resources.

#### Guidelines

1. During vegetation treatments, considerations of mesic microenvironments for woodland and talussnails endemic to the Santa Rita Ecosystem Management Area (such as trees near rocky features, islands of shrubs within talus slopes, riparian colluvia, large logs, and scattered rocks on shady hillsides) should be incorporated.
2. Management activities involving ground disturbance, vegetation management, or both should incorporate site-specific design features to benefit habitat for, or mitigate impacts to, rare or unique vertebrate, invertebrate and plant populations. For the Santa Rita Ecosystem Management Area, these species include, but are not limited to:
   - Arizona eryngo
   - Arizona Manihot
   - Ayenia
   - beardless chinch weed
   - Chisos Coralroot
   - Cochise woolwort
   - Huachuca cinquefoil
   - Pima pineapple cactus
   - purple-spike coral-root
   - Santa Rita yellowshow
   - Southwest monkeyflower

### Management Approach

1. Collaborating with the Friends of Madera Canyon and Friends of Kentucky Camp.

## Tumacacori Ecosystem Management Area

### General Description

The Tumacacori Ecosystem Management Area is the Coronado's most southwesterly administrative land unit, encompassing 200,929 acres. It is bounded by the Santa Cruz River on the east and the Altar Valley on the west. The Tumacacori Ecosystem Management Area shares 29 miles on its southern boundary with the U.S.-Mexico international border. At 6,422 feet, Atascosa Peak forms the summit of the ecosystem management area, presiding over the rugged and rocky Atascosa Mountains and Tumacacori Highlands. Vast rolling landscapes of grasslands and oak woodlands cascade in all directions from these dominating features. Water is a comparatively abundant feature of this ecosystem management area. Aliso Spring, on the northwest slope of the Tumacacori Mountains, provides rare habitat for lowland leopard frogs and other aquatic obligates. Further south, canyons of the Pajarito Mountains open into Mexico, harboring riparian vegetation and a fantastic diversity of birds, mammals, and reptiles. One such drainage, Sycamore Canyon, has long been world-renowned for bird watching opportunities and was recognized in 2003 as an important birding area by the Arizona Chapter of the Audubon Society. The Tumacacori Ecosystem Management Area generally remains wild in character, with developed recreation focused on Pena Blanca and Arivaca Lakes and dispersed recreation abundant within

its boundaries. The 7,523-acre Pajarita Wilderness lies in the southern portion of the ecosystem management area.

In addition to outstanding biophysical features, the Tumacacori Ecosystem Management Area is also rich in cultural history. The area was associated primarily with the O'odham people. They were the group living in and around the area when Europeans arrived, and though decimated in the 1st century of direct contact, they were still using the area on a regular basis into the 20th century. Other groups (including Apaches and particularly western Apaches)[39] visited often in the 18th and 19th centuries and lived just east of the ecosystem management area at the presidio community of Tubac in the 19th century. The Yaquis, or Yoemem, are best known for their use of the Highlands area in the early 20th century, but their presence dates to the time of initial Jesuit entry into the region. Other groups have more limited historic period connections with the area. Both the Hopi and Zuni have connections from the standpoint that they consider some of the ancestors of Tribal members to have migrated from southern Arizona. The O'odham occupation of the Tumacacori Ecosystem Management Area ended abruptly in 1916 when the main Papago Indian Reservation was created and those Tohono O'odham living outside the boundaries were forced to leave the area and move to the reservation.

**Wild Chile Botanical Area.** This 2,836-acre area within the Rock Corral Canyon subwatershed was designated in 1999 to provide additional notoriety, protection, and research opportunities for the wild chile (*Capsicum annuum* var. *aviculare*) and other plants of economic importance or conservation concern. Primarily consisting of oak woodlands, interspersed with semidesert grasslands and deciduous riparian vegetation, the area harbors wild chile plants occurring at the northernmost edge of wild chile populations found anywhere in the world.

Known as chiltepines in Mexico, where they are more common, wild chiles have been traditionally harvested in the area for decades, if not centuries, and are an important food crop worldwide. Wild cotton, tepary beans, and two species of wild gourds are also found in the Wild Chile Botanical Area.

**Goodding Research Natural Area.** Originally established as Sycamore Scenic Area in 1962, the 540-acre Goodding Research Natural Area was renamed and given research natural area status in 1970. All but 7 acres are located within the Pajarita Wilderness. Widely recognized for its aesthetic and biological diversity, Leslie N. Goodding, the renowned Arizona botanist for whom it was named, called Goodding Research Natural Area a "hidden botanical garden." Besides sustaining rare and varied riparian vegetation and wildlife, the area was designated for its representation of the oak savannah vegetation community. An additional 1,673 acres were later proposed as the Goodding Research Natural Area Extension, with 1,472 of these acres located adjacent to the southern boundary of the existing research natural area, all within the Pajarita Wilderness. The remaining 201 acres straddle the wilderness boundary beyond the northern edge of the existing research natural area, and 51 acres of this portion are within the Pajarita Wilderness. The existing and proposed Goodding Research Natural Area combine to equal 2,213 acres. The proposed Goodding Research Natural Area Extension would further protect additional populations of rare plants and animals, including the supine bean.

[39] Western Apache refers to the Apache peoples living today primarily in east central Arizona. Most live within reservations. The Fort Apache, San Carlos, Yavapai-Apache, Tonto Apache, and Fort McDowell Mohave-Apache Indian reservations are home to the majority of western Apache and are the bases of their federally recognized Tribes.

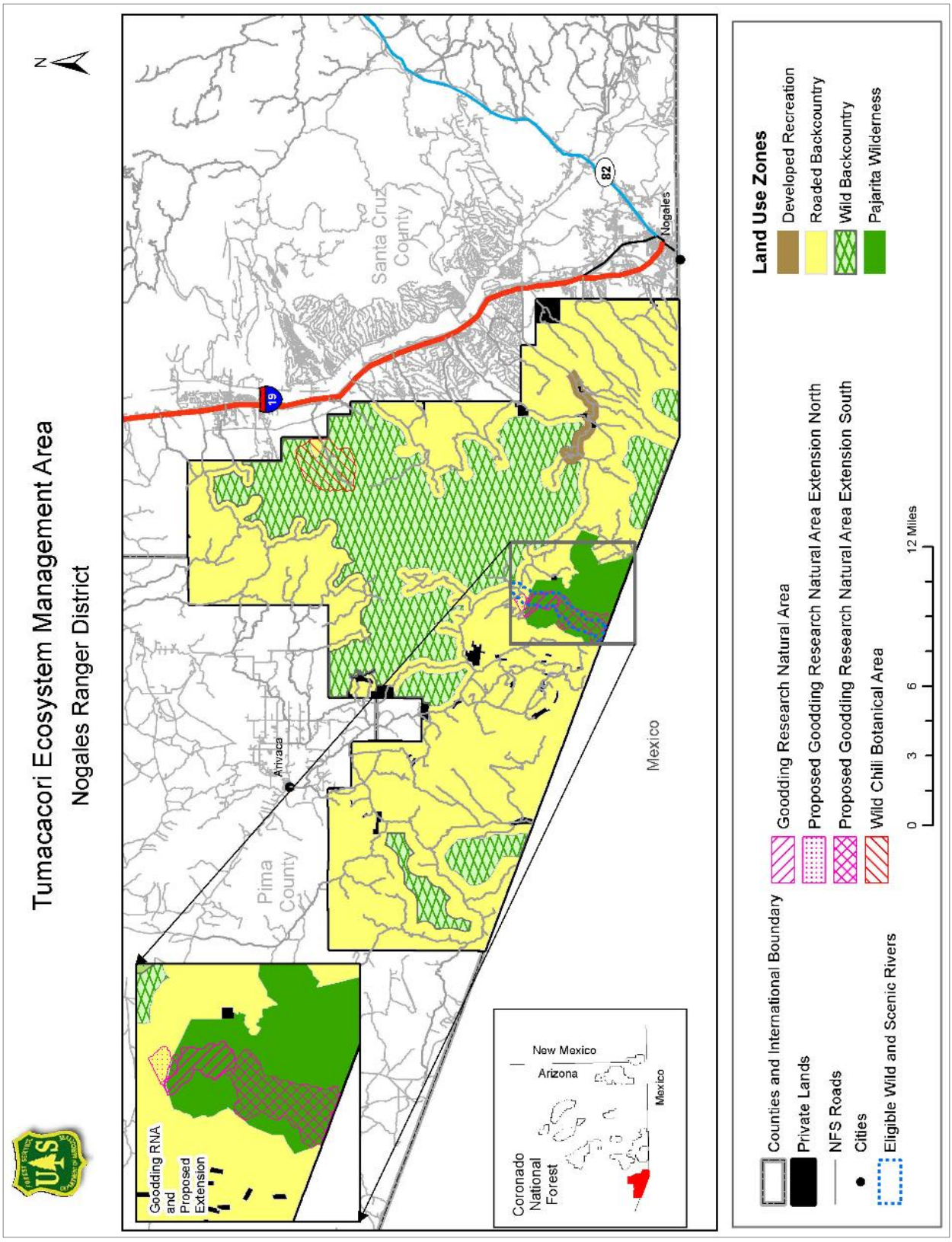


**Figure 9. Tumacacori Ecosystem Management Area land use zones and special areas**

### Desired Conditions

The Tumacacori Ecosystem Management Area offers a wide spectrum of developed recreation opportunities for a growing population, while large tracts of undeveloped areas remain available for primitive and dispersed recreation. The core mountainous and roadless area has a wild and rugged character. Ruby Road (NFS Road 39) provides scenic driving and vehicular access through the Tumacacori Ecosystem Management Area. Fishing and boating opportunities are provided at Pena Blanca and Arivaca Lakes. Well-maintained visitor facilities (including a boat ramp, lakeshore trail, overnight accommodations, picnic areas, and fishing docks) are available at Pena Blanca Lake. Water based recreational activities do not contribute to the spread of invasive aquatic species. California Gulch and Sycamore Canyon offer outstanding bird watching opportunities. Aliso Spring provides habitat for native aquatic species. The Tumacacori Ecosystem Management Area offers an environment in which to recreate where the risks are predominately natural and visitors do not feel threatened. The landscape has recovered from resource damage caused by illegal activities. Trash is not commonly found. Watersheds provide high quality surface and ground water flows.

Plants that are traditionally important to the O'odham people (including acorn bearing oaks, agaves, banana yucca, beargrass, walnuts, mulberry, chiltepines, and sayas) are available for sustainable traditional and cultural uses.

Historically significant buildings are maintained and rehabilitated for continued use. Multiple-use management of the Wild Chile Botanical Area perpetuates the existence of wild chiles. Traditional uses of wild chiles do not threaten existing populations.

Activities related to the international border minimally impact natural resources including scenic quality. Species that have historically moved freely between habitats in Mexico and within the Tumacacori Ecosystem Management Area continue to do so.

Permanent legal public access to the northern and eastern side of the ecosystem management area has been established, is easily accessible by public land and administrative users, and is connected to State, county, local public, and other Federal roads and trails. The complex land ownership patterns (fragmented checkerboard ownership intermingled with irregular-shaped parcels) within the ecosystem management area have been consolidated through land ownership adjustments, and boundaries are easily identifiable and recognizable by public land users, private landowners, and Forest Service personnel.

The Goodding Research Natural Area and its proposed extension retain the characteristics of the rare and varied riparian vegetation and wildlife, including the oak savannah vegetation community.

### Objective

1. Every 10 years treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 25 percent of the Tumacacori Ecosystem Management Area to create resiliency to disturbances. One-third of this treatment should target the area east of the Goodding Research Natural Area to Nogales, from the international border to the vicinity of Ruby Road. Treatments will be consistent with the objectives for forestwide vegetation communities and resources.

### Standards

1. Within Goodding Research Natural Area and the proposed Goodding Research Natural Area Extension:
   a. Do not permit livestock grazing.
   b. Do not permit harvest of forest products, including fuelwood.

### Guidelines

1. Fuel reduction and vegetation treatments should leave islands of mesic microenvironments around riparian areas, colluvium, and woody debris on side slopes and stream channels (ephemeral and perennial).
2. In rocky stream areas where large granitic boulders occur, projects should be designed to minimize or avoid impact to *Mannia californica* and *Plagiochasma wrightii* habitat.
3. Within the Wild Chile Botanical Area:
   a. Planned and unplanned ignitions should be used seasonally prior to wild chile flowering and fruiting.
   b. Livestock grazing should be deferred during the growing season of wild chiles, approximately August to November.
   c. Wild chile plants should be protected when high-severity fire threatens the population.
   d. A special use permit should be issued for any plant or animal collection (excluding traditional uses).
   e. A special use permit should be issued for scientific research that would involve placing anything on National Forest System lands within the proposed zoological area
4. Management activities involving ground disturbance and/or vegetation management should incorporate site-specific design features to benefit habitat for, or mitigate impacts to, rare or unique vertebrate, invertebrate and plant populations. For the Tumacacori Ecosystem Management Area, these species include, but are not limited to, the following:
   - Cochise woolwort, recurved corycactus, soft Mexican-orange, and Whisk fern

### Management Approaches

1. Fostering collaborative research to explore Native American history and heritage, such as working with the Pascua Yaqui to investigate the historic battle site near Bear Valley Ranch.
2. Supporting continued research and monitoring of wild chiles by Native Seeds/Southwestern Endangered Aridland Resource Clearing House[40] and other nonprofit or educational organizations. Providing opportunities for Tribes and the local communities to collect mesquite wood for personal use as part of vegetation management treatments.
3. Coordinating with the Department of Homeland Security in the protection of archaeological sites during law enforcement activities.

[40] Native Seeds/Southwestern Endangered Aridland Resource Clearing House conserves, distributes, and documents adapted and diverse varieties of agricultural seeds, their wild relatives, and the role these seeds play in cultures of the American Southwest and northwest Mexico. They promote the use of these ancient crops and their wild relatives by gathering, safeguarding, and distributing their seeds to farmers and gardening communities.

## Sierra Vista Ranger District

The Sierra Vista Ranger District consists of two ecosystem management areas: Huachuca and Whetstone. This ranger district shares 26 miles of the international boundary with Mexico.

### Huachuca Ecosystem Management Area

#### General Description

An expansive area containing 253,364 acres of land, the Huachuca Ecosystem Management Area includes the massive Huachuca Mountains, the smaller Patagonia Mountains and Canelo Hills, and the vast, rolling grasslands of San Rafael Valley. Fort Huachuca shares the ecosystem management area's northeastern border, and the entire south edge of the ecosystem management area lies on the international boundary with Mexico. The Miller Peak Wilderness encompasses 20,238 acres of the ecosystem management area's upper elevations in the Huachuca Mountains.

Several perennial streams—including Bear Canyon, Scotia Canyon, and Red Rock Canyon—provide year-round habitat for aquatic species. These streams generally have at least permanent pools of water, even when continuous flows cease during the driest seasons.

Ancestors of the Chiricahua Apache, western Apache, and O'odham once used the entire ecosystem management area and continue to visit areas near Fort Huachuca for acorn collection. Noted by 17th century Spanish Captain Juan Mateo Manje, the Huachuca range (or Sierra de Huachuca) most likely got its name from a nearby Piman village.

Numerous access roads penetrate the Huachuca Ecosystem Management Area, connecting to a network of unpaved roads within. The route from Montezuma Pass to Sonoita, via Parker Canyon Lake, is a favorite scenic drive navigable to two-wheel-drive vehicles despite having a dirt surface in most sections. Visitors concentrate along Carr Canyon, within campgrounds and picnic areas surrounding Parker Canyon Lake, and at eastside access points near the thriving community of Sierra Vista. Highway 82 closely borders the west side of the ecosystem management area, providing additional access for visitors to the Patagonia Mountains.

**Town of Patagonia Municipal Supply Watershed.** The 128,000-acre Sonoita Creek watershed is a municipal supply watershed. Harshaw Creek and their subterranean aquifers provide the only source of potable water for the town of Patagonia with over 900 residents and over 300 private well users within a 3-mile radius of town. The shallow depth of the aquifers combined with the nature of the soils and underlying geology make the relationship between the surface and ground water watersheds a particularly close and interconnected one.

**Appleton-Whittell Research Ranch**. Just south of Elgin at the north-northeastern edge of the ecosystem management area lies the Appleton-Whittell Research Ranch, a cooperative partnership among the National Audubon Society, Forest Service, Bureau of Land Management, the Nature Conservancy, Swift Current Land and Cattle Co., LLC, and the Research Ranch Foundation. Of a total 7,543 acres, 1,746 are National Forest System lands managed by the Coronado National Forest. The Appleton-Whittell Research Ranch is managed under a memorandum of understanding that emphasizes research, education, conservation, and restoration; it is particularly valued as a scientific control area. Special area designations on National Forest System land within the Appleton-Whittell Research Ranch contribute to these objectives, including the Elgin Research Natural Area. The Appleton-Whittell Research Ranch is not designated as an official research natural area but will be managed under a memorandum of understanding to meet similar objectives. Some vegetative manipulations will be allowed for research projects.

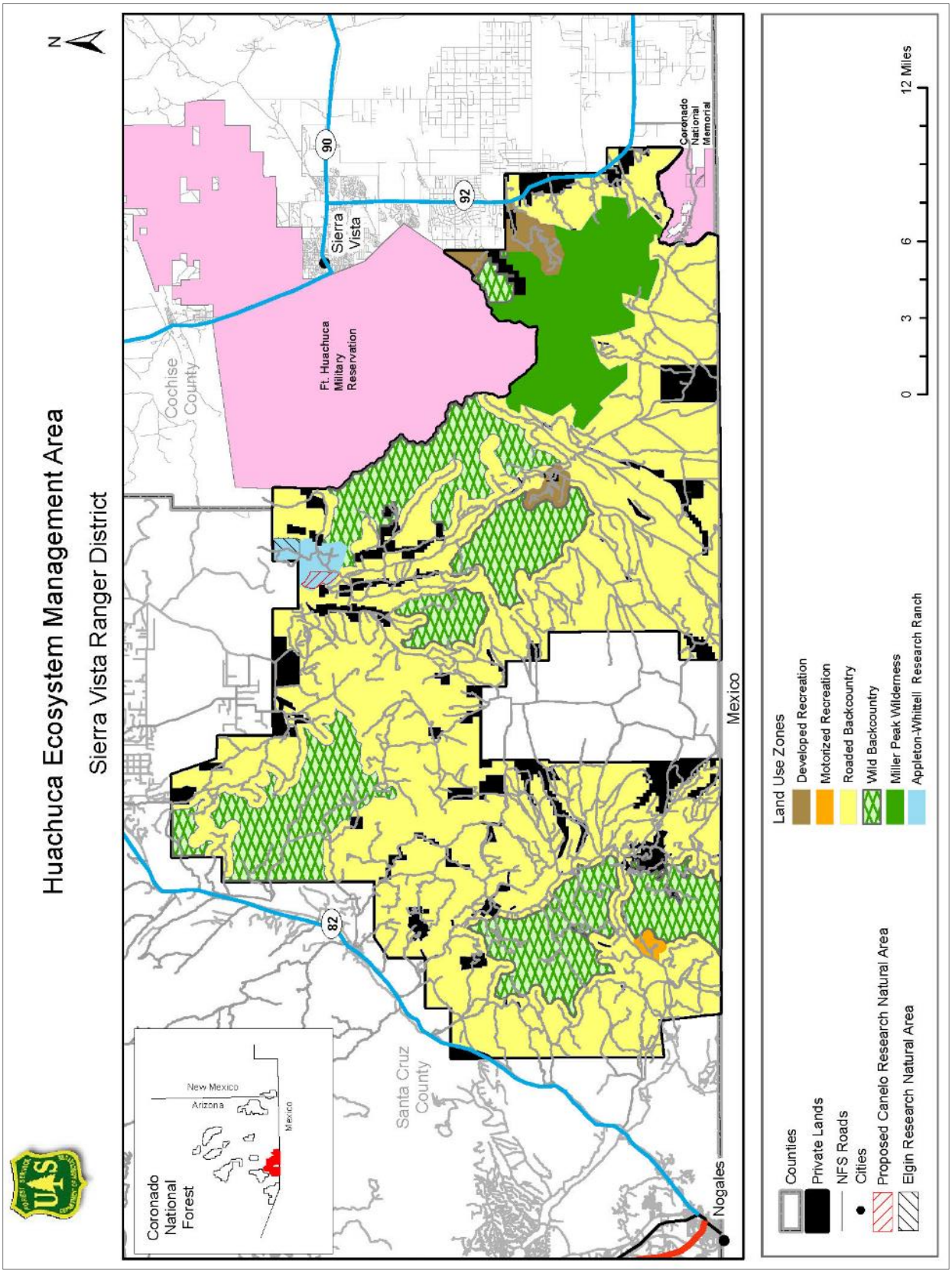


**Figure 10. Huachuca Ecosystem Management Area land use zones and special areas**

**Elgin Research Natural Area.** This research natural area was created in 1974 to provide opportunities to research shortgrass open grassland associations near the southwestern extremity of their normal range. Additionally, since domestic livestock have been absent for much of the latter half of the 20th century, the research natural area offers an excellent opportunity to study natural trends in vegetation composition and soil stability following removal of livestock grazing. The 480-acre tract of land is a mixture of State, Federal, and private land ownership, all within the Appleton-Whittell Research Ranch boundary; 245 acres are National Forest System lands.

**Proposed Canelo Research Natural Area.** Proposed for designation in the 1986 forest plan, the proposed Canelo Research Natural Area would set aside 386 acres of National Forest System lands within the southern portion of the Appleton-Whittell Research Ranch. Like the Elgin Research Natural Area, this proposed research natural area will be managed to allow for monitoring long-term ecological changes in the absence of livestock grazing. Canelo Research Natural Area would feature open oak (encinal) woodlands vegetation community. Turkey Creek flows perennially through the western portion of the proposed Canelo Research Natural Area, supporting diverse riparian habitat and rare aquatic species.

## Desired Conditions

The Huachuca Ecosystem Management Area offers a wide spectrum of developed recreation opportunities for a growing population, while large tracts of undeveloped areas remain available for primitive and dispersed recreation. Parker Canyon Lake provides developed recreation opportunities, including boating, sport fishing, camping, and picnicking. Recreational activities do not contribute to the spread of aquatic invasive species. Vistas from the Montezuma Pass route are highly scenic. The Arizona National Scenic Trail offers opportunities for hiking, cycling, and horseback riding across the ecosystem management area along a continuous north-south trending transect. A well-maintained road network provides many opportunities for vehicle-related activities without compromising the wild character of adjacent unroaded areas. World-class birding opportunities exist throughout the ecosystem management area. Acorn collection is facilitated for cultural, personal, and traditional use.

Perennial streams, including Bear Canyon, Scotia Canyon, and Red Rock Canyon, provide year-round habitat for aquatic species. These streams generally have at least permanent pools of water, even when continuous flows cease during the driest seasons. The Sonoita Creek watershed provides clean surface water flows.

The Elgin Research Natural Area retains the characteristics of the transition zone between southwestern grasslands and oak savanna. The proposed Canelo Research Natural Area protects the ecological integrity of an open oak (encinal) woodlands vegetation community, and it is a control for research on ecological changes in the absence of livestock grazing.

The Huachuca Ecosystem Management Area offers an environment in which to recreate where risks are predominately natural and visitors do not feel threatened. The landscape has recovered from resource damage caused by illegal activities. Trash is not commonly found. Activities related to the international border minimally impact natural resources including scenic quality. Wildlife species that have historically moved freely between habitats in Mexico and within the Huachuca Ecosystem Management Area continue to do so.

The legal status deficiencies of existing forest roads and trails to and within the ecosystem management area have been resolved and all needed roads currently providing public access to the ecosystem management area remain open, unless restricted for administrative purposes. The complex land ownership patterns of fragmented checkerboard ownership intermingled with

irregular-shaped parcels within the ecosystem management area have been consolidated through land ownership adjustments.

Scientists from colleges and universities, State and Federal agencies, nonprofit organizations, and independent associations use the Appleton-Whittell Research Ranch as a control or reference area to evaluate the effects of various land uses, including ranching, hunting, restoration activities, and recreation on grassland ecosystems.

### Objective

1. Every 10 years treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 25 percent of the Huachuca Ecosystem Management Area to create resiliency to disturbance. Treatments will be consistent with the objectives for forestwide vegetation communities and resources.

### Standard

1. Within Elgin Research Natural Area and the proposed Canelo Research Natural Area:
    a. Livestock grazing will not be permitted.
    b. Harvest of forest products, including fuelwood, will not be permitted.

### Guidelines

1. In aquatic habitats occupied by Arizona treefrog, water levels should be maintained or enhanced during breeding season to a level adequate to support reproduction.
2. Impacts from management actions such as grazing, vegetation treatments, and recreation should be mitigated within Arizona treefrog habitat.
3. During vegetation treatments, mesic microenvironments for woodland and talussnails endemic to the Huachuca Ecosystem Management Area (such as trees near rocky features, islands of shrubs within talus slopes, riparian colluvia, large logs, and scattered rocks on shady hillsides) should be protected.
4. Management activities involving ground disturbance, vegetation management, or both should incorporate site-specific design features to benefit habitat for, or mitigate impacts to, rare or unique vertebrate, invertebrate and plant populations. For the Huachuca Ecosystem Management Area, these species include, but are not limited to:
    - beardless chinch weed
    - Cochise woolwort
    - elusive browallia
    - Huachuca cinquefoil
    - Huachuca milkvetch
    - Huachuca water umbel
    - Pima pineapple cactus
    - purple-spike coralroot
    - Rusby’s hawkweed
    - smooth baby-bonnets

## Management Approach

1. Collaborating with Friends of Brown Canyon Ranch and Friends of the Huachucas.

## Whetstone Ecosystem Management Area

### General Description

At 44,384 acres, Whetstone Ecosystem Management Area is the Coronado's second smallest administrative land unit. Its namesake range, the Whetstone Mountains, provides a scenic backdrop for travelers along Interstate 10, with precipitous cliff bands rising dramatically from a sea of desert scrub and semidesert grassland. Apache Peak is the range's focal point, appropriately named for the western Apaches that considered these mountains part of their territory. Historically, the Whetstone Mountains were also within the territory of the Chiricahua Apache, and archaeological sites indicate long use by Hohokam, ancestral O'odham. Today, access is via primitive roads and trails, as this is one of the least developed ecosystem management areas on the Coronado. Trails originating in Karchner Caverns State Park at the northern border of the ecosystem management area are popular. There are no developed recreation sites, but opportunities for dispersed recreation abound.

### Desired Conditions

The wild character of the Whetstone Ecosystem Management Area is preserved, and there are many opportunities for solitude and quiet. Recreation opportunities are primarily undeveloped, and the entire ecosystem management area is available for primitive and dispersed recreation and hunting. The landscape has recovered from resource damage caused by illegal activities. Trash is not commonly found. Watersheds provide high quality surface and ground water flows. Riparian resources of French Joe Canyon provide a refuge for migratory birds and other riparian species.

The ecosystem management area is one contiguous block of Federal land within its proclaimed boundaries. There is permanent legal public road and trail access into the north, south, east, and western sides of the ecosystem management area. The ecosystem management area is easily accessible for public and administrative purposes and connected to State, county, local public, and other Federal roads and trails. Permanent legal public vehicular access to National Forest System lands in Anderson Canyon, Easter Mountain, and Cottonwood Canyon, Middle and Guindani Canyons, and other areas within the ecosystem management area is established.

### Objective

Every 10 years treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 15 percent of the Whetstone Ecosystem Management Area to create resiliency to disturbances. Treatments will be consistent with the objectives for forestwide vegetation communities and resources.

### Guideline

During vegetation treatments, mesic microenvironments for woodland and talussnails endemic to the Whetstone Ecosystem Management Area (such as trees near rocky features, islands of shrubs within talus slopes, riparian colluvia, large logs, and scattered rocks on shady hillsides) should be protected.

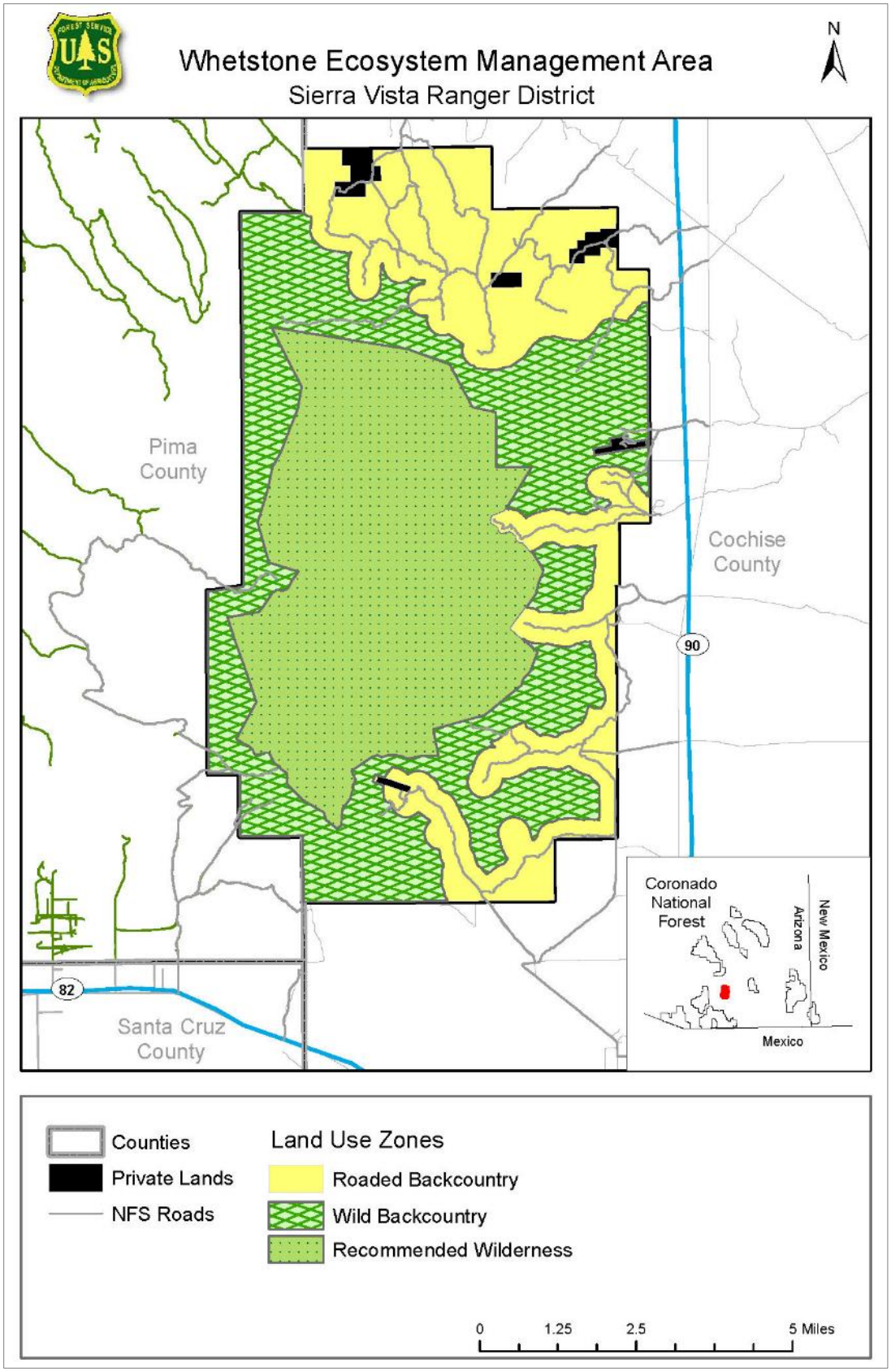


**Figure 11. Whetstone Ecosystem Management Area land use zones and special areas**

## Safford Ranger District

The Safford Ranger District consists of four ecosystem management areas: Galiuro, Pinaleño, Santa Teresa, and Winchester.

### Galiuro Ecosystem Management Area

#### General Description

The Galiuro Ecosystem Management Area encompasses 133,851 acres of primarily undeveloped lands, including 714 acres of private inholdings. Two major canyons, Rattlesnake and Redfield, and twin ridges running northeast to southwest form the dominant geologic features of the area. From golden grasslands, 7,651-foot Bassett Peak rises up to form the ecosystem management area's highest point. Access is mainly via gravel and dirt roads, mostly lying on the east side of the mountain, with travel generally restricted to foot and horseback in the interior of the range. There is one developed recreation area in the Galiuro Ecosystem Management Area. Dispersed areas throughout the mountains offer a wealth of opportunities for backcountry hiking, camping, and solitude. The 77,529-acre Galiuro Wilderness abuts Bureau of Land Management administered Redfield Canyon Wilderness to the south.

The Galiuro Mountains are rich in both cultural and natural history. The ecosystem management area was historically within the territory of the western Apaches. The Hopi Tribe and Zuni Pueblo have ancestral sites in the San Pedro Valley to the west, and likely used the Galiuro Mountains in centuries past. At Power's Cabin deep within the mountain range, a famous old west shoot-out took place in 1918. Wolves roamed the range until the mid-1950s, and black bear and mountain lion are still plentiful today.

#### Desired Conditions

The wild character of the Galiuro Ecosystem Management Area is preserved, and there are many opportunities for quiet recreation and solitude. Recreation opportunities are primarily undeveloped, and the entire ecosystem management area is available for primitive and dispersed recreation. Watersheds provide high quality surface and ground water flows. Powers Cabin is preserved as an historic site.

Land adjustments result in one contiguous block of Federal land from its original boundaries to the Winchester Ecosystem Management Area. The proclaimed national forest boundary at the southeast corner connects with the northwest corner of the Winchester Ecosystem Management Area.

There is permanent legal public road and trail access into all sides of the ecosystem management area, it is easily accessible by public land and administrative users, and it is connected to State, county, local public, and other Federal roads and trails. Permanent legal public vehicular access to National Forest System lands in the Schoenholzer Canyon, Copper Creek, Keilberg Canyon, and YLE Canyon area, Fourmile Canyon, First Trail Canyon, Rattlesnake Mesa and Willow Creek area, and other areas within the ecosystem management area is established and easily accessible by public land and administrative users.

#### Objective

Every 10 years treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 40 percent of the Galiuro Ecosystem Management Area to create resiliency to disturbances. Treatments will be consistent with the objectives for forestwide vegetation communities and resources.

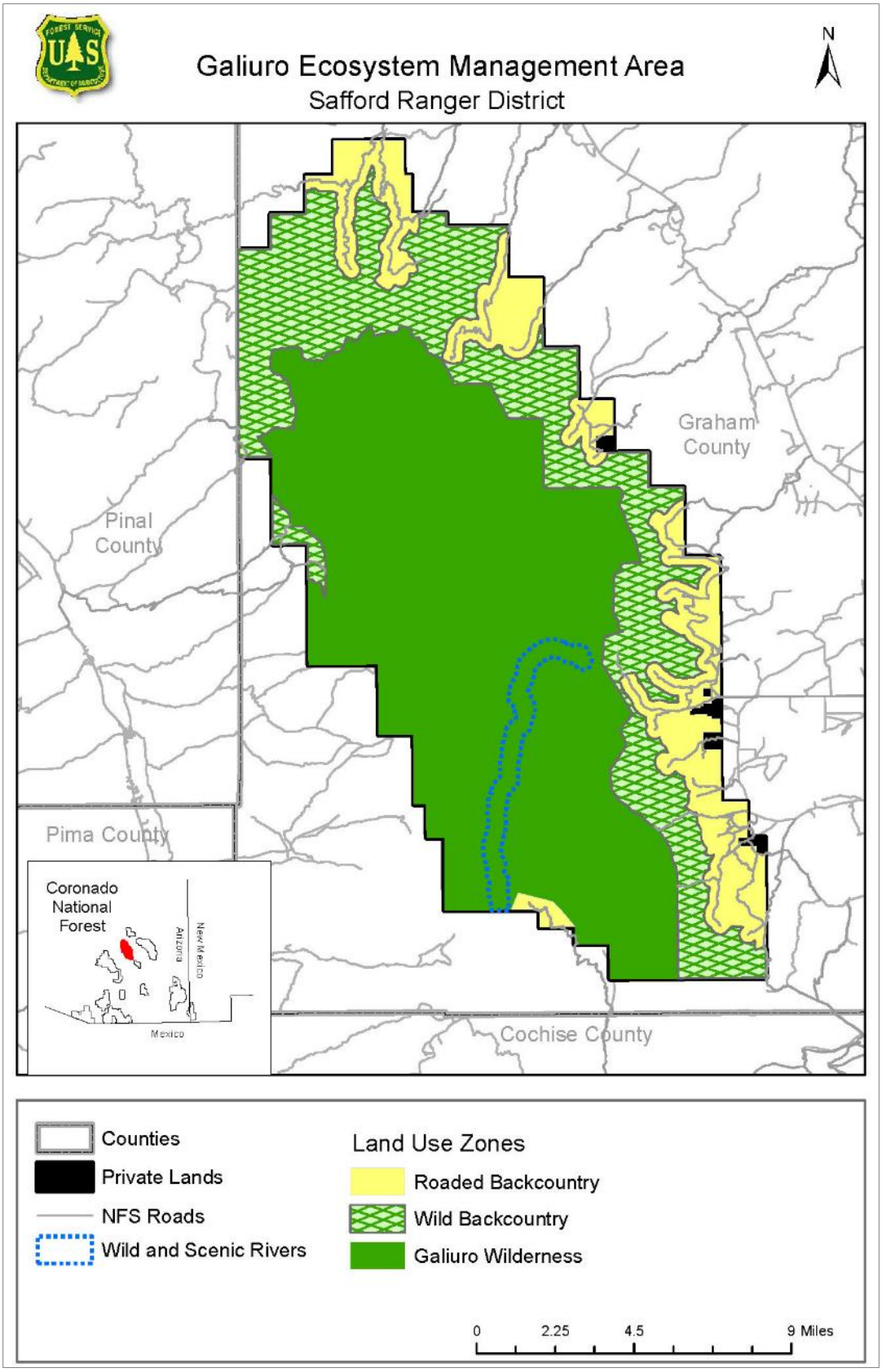


**Figure 12. Galiuro Ecosystem Management Area land use zones and special areas**

## Pinaleño Ecosystem Management Area

### General Description

The Pinaleño Ecosystem Management Area encompasses a massive mountain range of 198,200 acres. The Pinaleño Ecosystem Management Area has elevations well over 10,000 feet and dwarfs surrounding ranges. This ecosystem management area rises from the surrounding semidesert grasslands up to the Coronado's only representative spruce-fir vegetation community. Residents of Gila Valley (Safford, Thatcher, and other communities) consider Mount Graham a special place, part of a tradition of retreating to the mountain for relief from summer heat. The entire range (or *Dził Nchaa Si'an*) has been formally recognized as a traditional cultural property important to the western Apache groups, including White Mountain, San Carlos, and Yavapai Apache, and as a place of outstanding significance in western Apache religion, culture, and history. The mountain continues to play a vital role in western Apache lifeways and Tribal well-being. *Dził Nchaa Si'an* is home to mountain spirits, serves as a source of natural resources and traditional medicine for ceremonial uses, and is used as a place of prayer and a source of power to western Apache people. The Hopi Tribe, Pueblo of Zuni, and the Four Southern Tribes of Arizona also have sacred sites and shrines within the Pinaleño Mountains. The entire ecosystem management area has been determined eligible for listing on the National Register of Historic Places. Primary access into the mountains is via State Highways 366 (which was designated "Swift Trail Parkway" by Arizona Department of Transportation in 1992) and 266 (over Stockton Pass). Nonmotorized trails penetrate the range for travel by foot and horseback. One of these, Arcadia Trail (328), was named "Arcadia National Recreation Trail" by the Chief of the Forest Service in 1979.

Visitor facilities include developed campgrounds, picnic areas, and a visitor center that is staffed partly by volunteers. There are also many popular locations for dispersed recreation. Large unroaded areas, including the Mount Graham Wilderness Study Area, offer opportunities for backcountry hiking and solitude. Additionally, three special management/emphasis zones contribute to the uniqueness of the ecosystem management area: the Goudy Canyon Research Natural Area, Wet Canyon Talussnail Zoological Area, and Mount Graham Astrophysical and Biological Research Area. University of Arizona's Mount Graham International Observatory has become an important astrophysical research facility and contributes to the rich multiple-use history of the range. The 61,315-acre recommended Mount Graham Wilderness Study Area circles the high peaks of the ecosystem management area.

**Goudy Canyon Research Natural Area**. A 558-acre portion of the ecosystem management area's mixed conifer forests within Goudy Canyon was designated a research natural area in 1972 to provide opportunities to study Mexican white pine (now considered Southwestern white pine) and Douglas-fir in near optimal stand conditions. The recommended Mount Graham Wilderness Area overlaps the entire research natural area. Motorized access to the northern boundary of Goudy Canyon Research Natural Area is easily available via the Swift Trail, providing opportunities for wilderness-oriented recreation to occur.

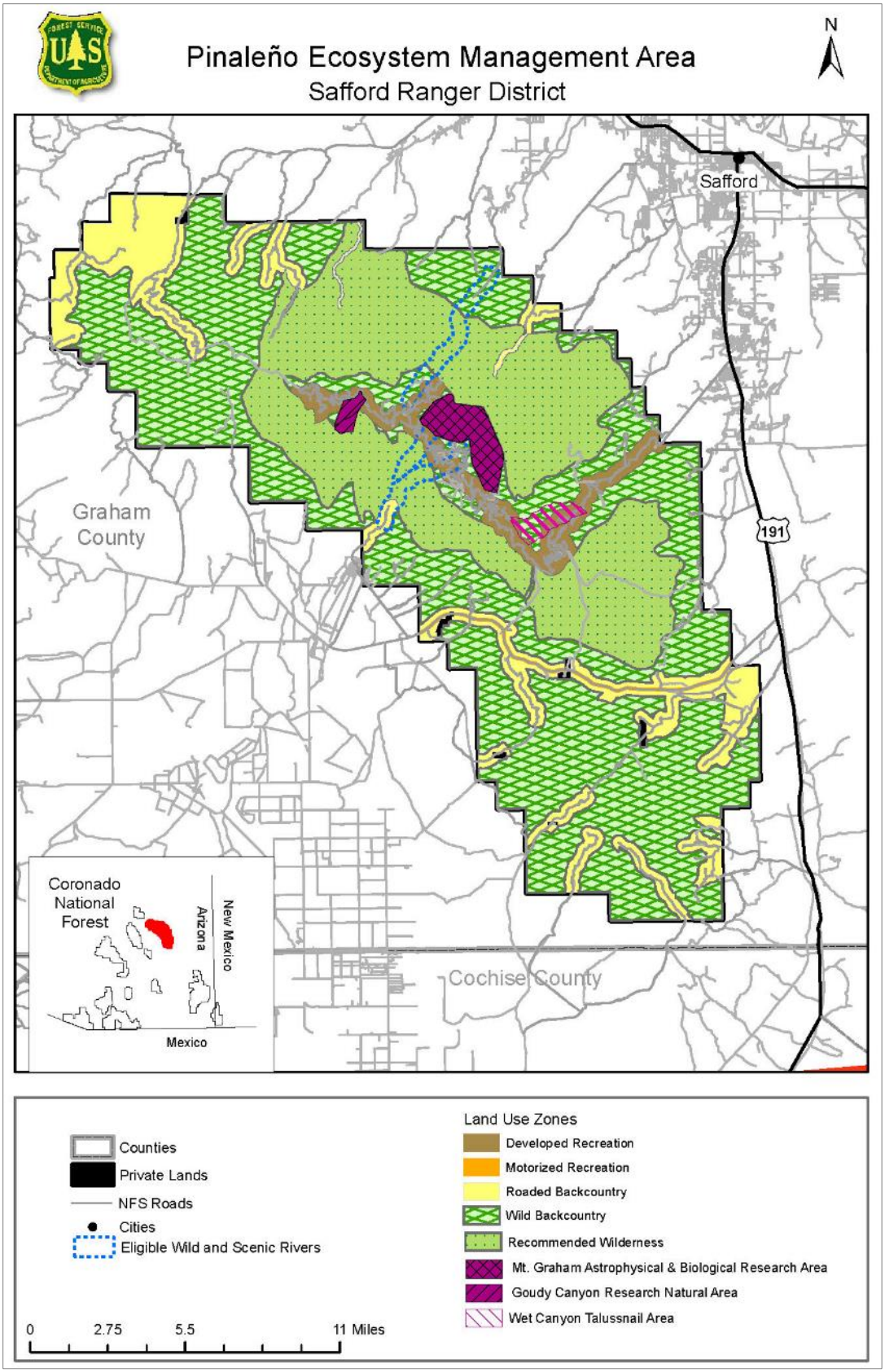


**Figure 13. Pinaleño Ecosystem Management Area land use zones and special areas**

**Wet Canyon Talussnail Zoological Area**. On the eastern slope of the Pinaleño Mountains, 1,218 acres of the Wet Canyon talussnail's (*Sonorella macrophallus*) optimal habitat and the watershed that surrounds it is protected within this special area, recognized in a 1998 forest plan amendment. As the name implies, this land snail is restricted to talus slopes in canyon bottoms, and is barely more than a half an inch in diameter. It is endemic to the Pinaleño Mountains, and perhaps even to the Wet Canyon watershed. Five other talussnails are also endemic to the Pinaleño Mountains; they share common habitat requirements and therefore, mutually benefit from the existence of the Wet Canyon Talussnail Zoological Area.

**Mount Graham Astrophysical and Biological Research Area.** Designated in 1989 by the Arizona-Idaho Conservation Act, this area encompasses 2,937 acres in the highest elevations of the Pinaleño Ecosystem Management Area. Management of the Mount Graham Astrophysical and Biological Research Area places emphasis on biological research for the Mount Graham red squirrel and spruce-fir vegetation type at the Mount Graham Red Squirrel Refugium, and astronomical research at the Mount Graham International Observatory.

### Desired Conditions

The Pinaleño Ecosystem Management Area offers a wide spectrum of developed recreation opportunities for a growing public, while large tracts of undeveloped areas remain available for primitive and dispersed recreation. The Swift Trail Parkway, a State designated scenic byway, provides vehicular access to the ecosystem management area's primary recreational opportunities year round and access to high elevations from spring to fall. The scenic, natural qualities valued by visitors are retained. Interpretive signs along Swift Trail provide educational information about the surrounding natural and cultural resources. Trails in the Mount Graham Astrophysical and Biological Research Area are open to hikers and visitors who are provided with information about the cultural significance of the area and the ways to be respectful.

Recreation facilities are sufficient in size and number to accommodate demand and support a high-quality outdoor experience. Riggs Lake and Frye Mesa Reservoir offer opportunities for fishing and other lake-based recreation. These activities do not contribute to the spread of invasive aquatic species. Up-to-date, locally focused, and science based natural and cultural information is available to visitors at the Columbine Visitor Center. Horse corrals at several recreation sites along Swift Trail offer equestrians places to organize rides and camp. Recreation residences and the Columbine organization camp blend well with the natural landscape and do not expand beyond their authorized footprints. Permanent legal public vehicular access to National Forest System lands in the ecosystem management area is established and easily accessible by public land and administrative users.

The integrity of the western Apache Traditional Cultural Property is retained or improved wherever feasible. Members of Tribes have access to *Dził Nchaa Si'an*, Mount Graham, for ceremonial, religious, collecting, and gathering activities. The mountain provides a setting for the education of Tribal youth in culture, history, and land stewardship. When available, national forest administrative sites may be used by Tribal families and organizations through government-to-government agreements. Interpretive and educational exhibits or other media that focus on the history of the Coronado, provide the public a greater understanding and appreciation of Apache history, culture, and traditions. Traditional uses, such as the collection of medicinal plants, wild plant foods, basketry materials, and fuelwood, are available for collection by Tribal members.

The dark skies above the Pinaleño Ecosystem Management Area present conditions conducive to astronomical research. Existing telescopes offer educational opportunities and promote scientific discovery. Researchers, employees, students, volunteers who visit the Mount Graham

International Observatory, and observatory employees are informed about the importance of *Dził Nchaa Si'an* to western Apache people and how to be respectful when visiting, living, residing, or working on the mountain.

High-elevation meadows are dominated by native grasses and grasslike plants and are relatively free of trees and shrubs. The spruce-fir vegetation community is regenerating with species representative of a healthy mix of spruce-fir seral stages. The Wet Canyon watershed provides habitat for the Wet Canyon talussnail. Watersheds provide high quality surface and ground water flows. The Mount Graham Astronomical and Biological Research Area provides habitat for the Mount Graham red squirrel and astrophysical research at the Mount Graham International Observatory. Recreational uses or management activities do not degrade these special habitats. The Goudy Canyon Research Natural Area retains the characteristics of Mexican white pine and Douglas-fir stands.

### Objective

1. Every 10 years treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 25 percent of the Pinaleño Ecosystem Management Area to create resiliency to disturbances. Treatments will be consistent with the objectives for forestwide vegetation communities and resources.

### Standards

1. Within the Goudy Canyon Research Natural Area:
    a. Wildlife habitat improvement, water yield improvement, and related improvement projects are prohibited.
    b. Vegetation manipulation, including timber sale and harvest of forest products, will not be allowed except for approved research purposes.
2. Within habitat for the Mount Graham red squirrel, no new recreational residence or developed recreation areas will be established.

### Guidelines

1. Management activities involving ground disturbance, vegetation management, or both should incorporate site-specific design features to benefit habitat for, or mitigate impacts to, rare or unique vertebrate, invertebrate and plant populations. For the Pinaleño Ecosystem Management Area, these species include, but are not limited to:
    - broad-leaf ground-cherry, leafy Jacob's ladder, Rusby's hawkweed, and white-flowered cinquefoil
2. Planned and unplanned ignitions should be used to reduce the risk of uncharacteristic wildfires that can cause sedimentation, diminished water quality, and soil erosion in talussnail habitat.
3. Within habitat for Mount Graham red squirrel:
    a. Red squirrel habitat needs should supersede the needs of all other species of plants and animals.
    b. Hiking use levels should not negatively impact Mount Graham red squirrel habitat or individuals.
    c. Vegetation treatments should be designed and implemented to avoid disturbance of Mount Graham red squirrel middens.

### Management Approaches

1. Considering mesic microenvironments for woodland and talussnails endemic to the Pinaleño Ecosystem Management Area (such as trees near rocky features, islands of shrubs within talus slopes, riparian colluvia, large logs, scattered rocks on shady hillsides) when doing vegetation treatments.
2. Managing for the protection and physical integrity of the ecosystem management area as a traditional cultural property in full partnership with western Apache Tribes.
3. Encouraging western Apache Tribal members to pursue careers in the Forest Service and contribute to the Coronado National Forest's ability to adapt traditional knowledge to modern land management practices.
4. Working with the University of Arizona and western Apache Tribes to mitigate or reduce the effects of the Mount Graham International Observatory on the traditional cultural property.
5. Encouraging scientific investigation of talussnail life history traits (including reproduction, recruitment, mortality, population trends, ecology, and so forth) to increase understanding of, and the ability to manage, this unique taxon.
6. Using education to improve understanding of special management areas.
7. Acquiring and maintaining instream water rights on Wet Canyon Creek.
8. Collaborating with the Pinaleño Partnership in their area of interest.

## Santa Teresa Ecosystem Management Area

### General Description

The 48,902-acre Santa Teresa Ecosystem Management Area comprises the Coronado's most northerly administrative land unit, located just beyond and between the Galiuro and Pinaleño Mountains. The ecosystem management area's Santa Teresa range is a network of rugged mountains with bald summits, deep canyons, and sprawling mesas. Extremely rugged Holdout Canyon typifies the Santa Teresa Mountains; abundant caves and alcoves hollow into eroded cliffs with picturesque formations. Vegetation is predominantly thick chaparral with forests of ponderosa pine occupying high ridges. A stand of Douglas-fir grows on the sheltered north slope of Cottonwood Peak, the highest in the range at 7,481 feet. The 26,891-acre Santa Teresa Wilderness encompasses more than half of the ecosystem management area.

Bordering the ecosystem management area to the north is the San Carlos Apache Reservation, also part of the Santa Teresa range. These mountains also lie within the aboriginal territories of the western Apaches and the Four Southern Tribes, and may have been part of the migration routes used by ancestral pueblo groups. As one of the least developed ecosystem management areas within the Coronado National Forest, access into Santa Teresa Ecosystem Management Area is via gravel and dirt roads or by hiking trails. There are no developed recreation areas, although opportunities for backcountry hiking, camping, and picnicking are abundant.

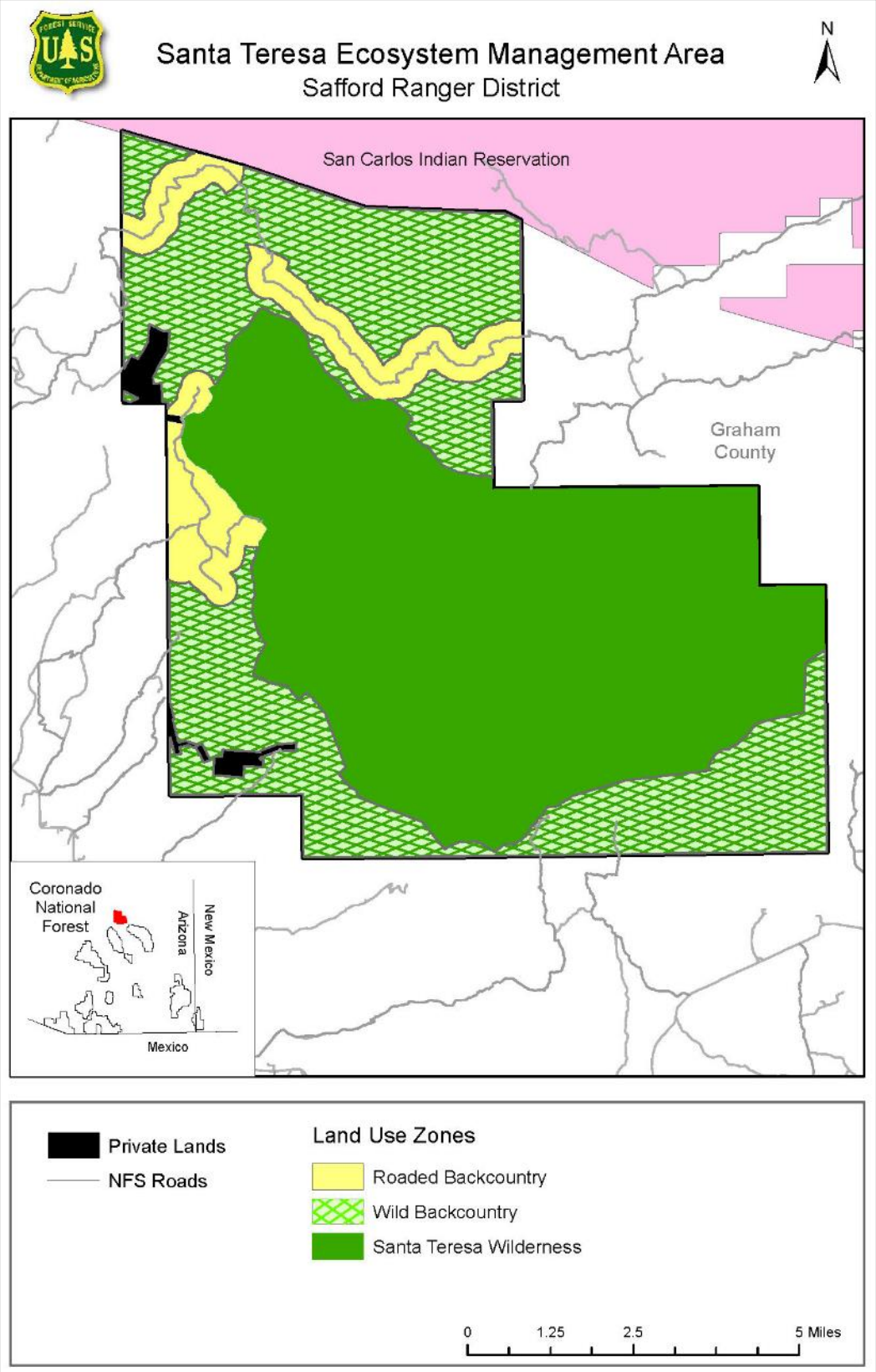


**Figure 14. Santa Teresa Ecosystem Management Area land use zones and special areas**

#### Desired Conditions

The wild character of the Santa Teresa Ecosystem Management Area is preserved, and there are many opportunities for quiet recreation and solitude. Recreation opportunities are primarily undeveloped. The entire ecosystem management area is available for primitive and dispersed recreation. Watersheds provide high quality surface and ground water flows. Permanent legal public vehicular access to National Forest System lands in the ecosystem management area is established and easily accessible by public land and administrative users.

#### Objective

Every 10 years treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 40 percent of the Santa Teresa Ecosystem Management Area to create resiliency to disturbances. Treatments will be consistent with the objectives for forestwide vegetation communities and resources.

## Winchester Ecosystem Management Area

### General Description

Less than half the size of the next largest ecosystem management area, Winchester Ecosystem Management Area contains 18,937 acres. The administrative boundary is considerably larger, yet a significant portion of that acreage is owned by the State of Arizona. The mountains that give this ecosystem management area its name are a small range situated just southeast of the Galiuro Mountains; Reiley Peak forms the apex of the Winchester Mountains, rising to over 7,500 feet in elevation. Part of the Apache territory when Euro-Americans entered the region, this range was evidently visited by Native American groups for thousands of years. Winchester Ecosystem Management Area offers opportunities for primitive recreation and solitude. Access is via primitive roads, with much of the ecosystem management area accessible only by hiking cross country. There are no developed recreation areas in the ecosystem management area, although there are good opportunities for backcountry hiking, camping, and solitude.

#### Desired Conditions

The wild character of the Winchester Ecosystem Management Area is preserved, and there are many opportunities for quiet recreation and solitude. Recreation opportunities are primarily undeveloped. The entire ecosystem management area is available for primitive and dispersed recreation. Watersheds provide high quality surface and ground water flows. Permanent legal public vehicular access to National Forest System lands in the ecosystem management area is established and easily accessible by public land and administrative users.

#### Objective

1. Every 10 years treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 10 percent of the Winchester Ecosystem Management Area to create resiliency to disturbances. Treatments will be consistent with the objectives for forestwide vegetation communities and resources.

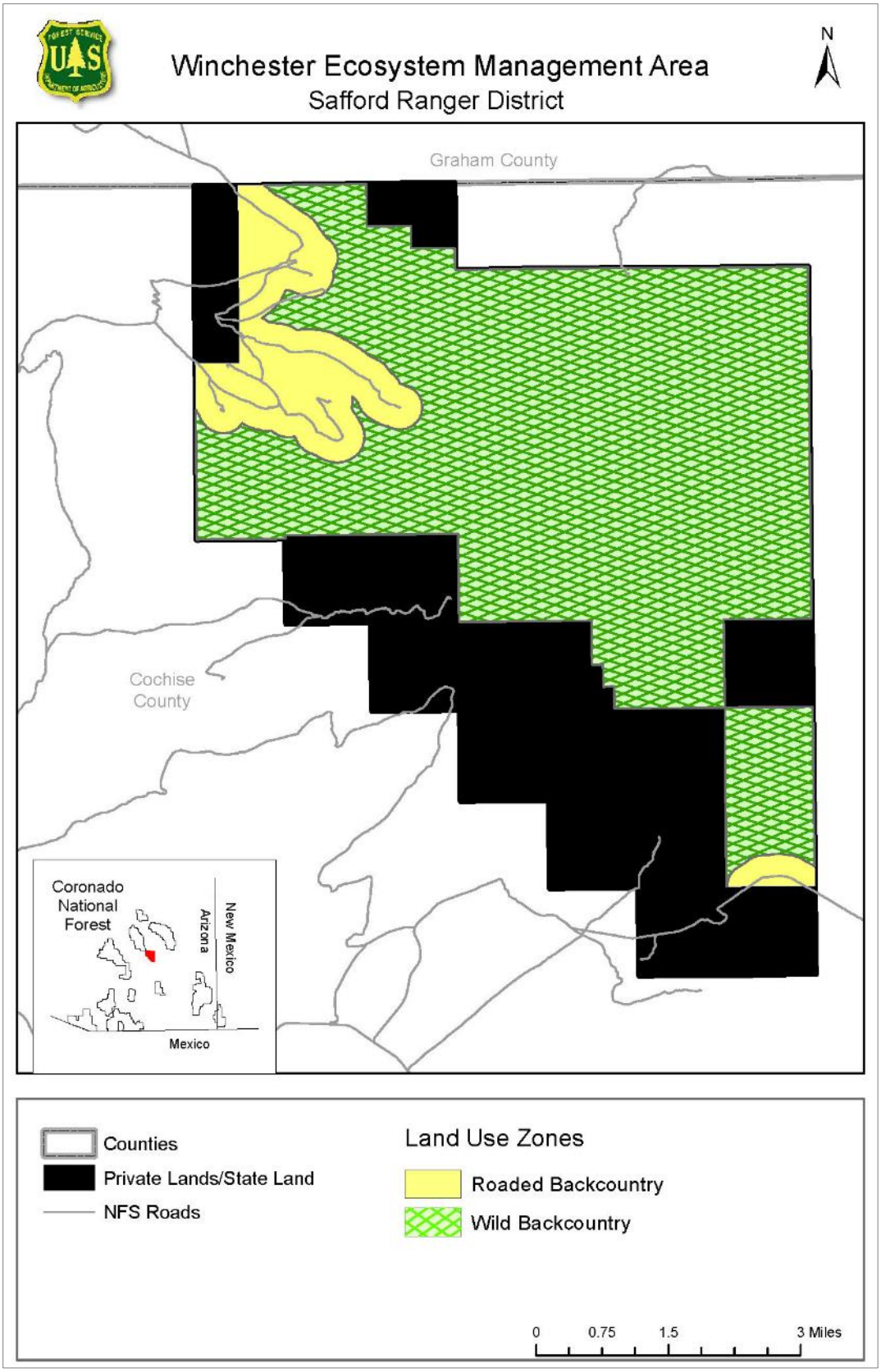


**Figure 15. Winchester Ecosystem Management Area land use zones and special areas**

## Santa Catalina Ranger District

The Santa Catalina Ranger District consists of only one ecosystem management area, the Santa Catalina.

### Santa Catalina Ecosystem Management Area

#### General Description

The 260,194-acre Santa Catalina Ecosystem Management Area wraps around the northern and eastern sides of the Tucson basin, dominating the viewshed from most parts of the city of Tucson. Elevations range from 2,200 feet at the valley edges to 9,157 feet on Mount Lemmon. The ecosystem management area is comprised of two mountain ranges, the Rincon Mountains and Santa Catalina Mountains. Nearly all of the Coronado's vegetation communities are represented within the Santa Catalina Ecosystem Management Area. Historically, both ranges were within the aboriginal territories of the O'odham and Apaches. Large archaeological sites in the foothills and small shrines atop peaks are important to the Zuni and Hopi. There are two designated wilderness areas in the ecosystem management area, the 56,919-acre Pusch Ridge Wilderness in the Santa Catalina Mountains and the 36,926-acre Rincon Wilderness in the Rincon Mountains. The boundary of the Rincon Wilderness is shared with Saguaro National Park.

The north-facing portion of the Santa Catalina Mountains exhibits a number of natural features of interest. Samaniego Ridge and Reef of Rocks dramatically rise to the crest of the range, parallel ridges that harbor Santa Catalina's longest drainage, Cañado del Oro, at nearly 25 miles in length. This canyon and Sabino Canyon are the only known drainages in this range to have historically contained native fishes. Alder Canyon, on the east slope of the Santa Catalina Mountains, is notable for its large deposits of limestone and dolomite, which are uncommon within the range at these concentrations. An interrupted perennial stream flows from multiple springs and seasonal snowmelt, making Alder Canyon particularly lush; it is probably second only to Sabino Canyon in terms of biological diversity. Lowland leopard frogs, canyon tree frogs, coatimundi, and riparian vegetation are abundant.

This ecosystem management area receives more visitors than any other area of the Coronado National Forest. It provides a sanctuary to desert dwellers during the intense heat of summer and an opportunity to enjoy snow each winter. Mount Lemmon's Ski Valley is the southernmost ski area in the continental U.S., offering rare skiing opportunities and a popular "sky ride" during months without snow. Trails wander the many canyons, ridges, valleys, and forests of the Santa Catalina Ecosystem Management Area, including the Arizona National Scenic Trail that traverses both mountain ranges. The primary access route into the Santa Catalina Mountains is the Catalina (or General Hitchcock) Highway. The highway was designated a scenic route by Pima County, the "Sky Island Scenic Byway" by the Chief of the Forest Service in 1995, and "Sky Island Parkway" by the Federal Highway Administration (USDOT) in 2001. Visitor facilities are concentrated along the Catalina Highway, in Sabino Canyon, and in Catalina State Park, which is managed by the State of Arizona and administered by the Forest Service. Dispersed recreation is abundant within designated wilderness areas, as well as on the north and east aspects of the Santa Catalina Mountains and throughout the Rincon Mountains.

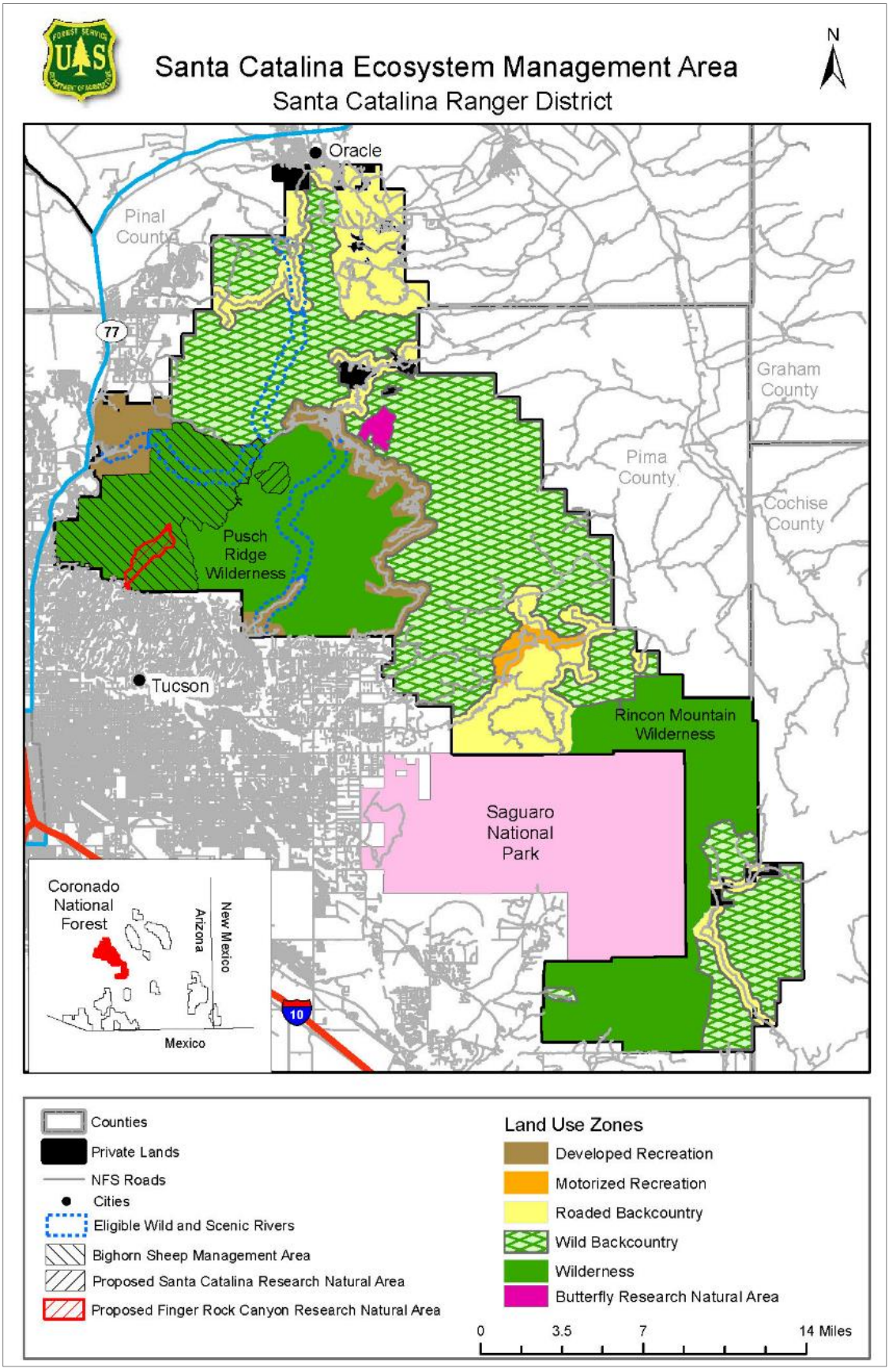


**Figure 16. Santa Catalina Ecosystem Management Area land use zones and special areas**

**Sabino Canyon Recreation Area**. This designated recreation area covers 1,423 acres in Sabino and Bear Canyons. The area serves as a popular recreational gateway into the nearby Pusch Ridge Wilderness and Santa Catalina Mountains. The peak visitation season at the Sabino Canyon Recreation Area falls between the months of November and April, with lower visitation in the summer months. An estimated 1.25 million visitors use the recreation area every year; primarily uses include hiking, walking, running, shuttle riding, picnicking, wildlife observation, photography, and nature study. Of the 18 trails originating in the recreation area, the majority extend beyond the boundary of the designated recreation area into the Pusch Ridge Wilderness and Santa Catalina Mountains. The area has several intermittent and flowing water sources, including the Sabino Dam and the pools at Seven Falls.

**Butterfly Peak Research Natural Area.** The 1,058 acres of land at the head of Alder Canyon on the eastern slope of the Santa Catalina Mountains were set aside in 1935 as Butterfly Peak Research Natural Area. The area was noted to contain one of the largest varieties of trees and shrubs in any one place in the Southwest, including at least 7 coniferous species, 11 broadleaf species, and a wide range of shrubs and herbs. Steep topography naturally limits timber harvest, livestock grazing, and mineral exploration, and the only trail that enters the area would be considered strenuous by most hikers. As such, visitation is low, making it an ideal place to conduct research within the ponderosa pine-evergreen shrub vegetation community.

**Santa Catalina Research Natural Area.** This area was designated in 1927 as the Nation's first research natural area. The Pusch Ridge Wilderness overlaps the area entirely and is dominated by widely dispersed ponderosa pines. The original 4,464 acres were advocated by the Tucson Natural History Society for the study of flora, as well as for appreciation of the outdoors and other purposes. Adjustments to the original size have been made since establishment. In 1962, a small reduction was made for special uses that were in conflict with research natural area system intentions and the research natural area was reduced to 4,040 acres. In 1986, it was proposed in the forest plan to reduce the research natural area to 634 acres to eliminate a large area heavily used for dispersed recreation. Until the Rocky Mountain Research Station director and the regional forester act on the recommendation to reduce the size of the research natural area, the existing 4,040 acres will continue to be managed as a research natural area.

**Proposed Finger Rock Canyon Research Natural Area.** The proposed research natural area covers 1,103 acres and includes the 5-mile Finger Rock Trail. It encompasses a xeroriparian system that is biologically rich, provides a corridor for wildlife movement, and is a refugium for rare flora and fauna. The Pusch Ridge Wilderness overlaps almost the entire proposed research natural area. Wilderness management applies to the proposed research natural area and recreational use within the area will continue.

**Bighorn Sheep Management Area.**[41] This special management area covers 21,184 acres in the Santa Catalina Mountains. The entire Bighorn Sheep Management Area lies within the Pusch Ridge Wilderness. An amendment to the 1986 forest plan established this area to be specially managed to maintain bighorn sheep habitat. A program emphasis is to manage the risk of disease transmission from domestic sheep and goats to bighorn sheep. Risk of disease transmission comes

[41] The Bighorn Sheep Management Area is the name of a special management area located in the Santa Catalina Ecosystem Management Area. It is different than the forestwide management areas described in chapter 2. For more information on special management areas, refer to the "Research Natural Areas, Botanical, Zoological, and Other Special Areas" section on page 121.

from grazing as well as packing. To manage that risk, a standard is applied for domestic sheep and goats within the national forest.

### Desired Conditions

The Santa Catalina Ecosystem Management Area offers a wide spectrum of developed recreation opportunities for a growing population, while large tracts of undeveloped areas remain for primitive and dispersed recreation. In the Sabino Canyon Recreation Area, developed recreation opportunities exist along the roadways, including access to the biologically rich Sabino Creek, and opportunities for dispersed and quiet recreation exist away from the main travel corridors. In the Redington Pass area, backcountry-touring routes are available for visitors who operate off-highway and all-terrain vehicles responsibly. Visitors to this area can enjoy the outdoors in clean, natural settings without conflicts with unsafe or illegal activities or exposure to excessive noise and disturbance. Recreational target shooting occurs in safe and well-monitored locations. The Sky Island Scenic Byway retains the qualities that earned national designation as a scenic byway. It provides year-round vehicular access to outstanding natural scenery and high elevations for a variety of developed and undeveloped recreational opportunities, as well as access to the community of Summerhaven. Interpretive signs help visitors learn about conservation of the natural and cultural resources in the area.

Fishing opportunities at Rose Canyon Lake are available to the public. Water based recreational activities do not contribute to the spread of invasive aquatic species. Up-to-date, locally focused, and science based natural and cultural information is available to visitors at the Palisades and Sabino Canyon Visitor Centers. Watersheds provide high quality surface and ground water flows. Recreation residences and organization camps blend well with the natural landscape and do not expand beyond their authorized footprints. The geologic features and rock formations that dominate the Santa Catalina scenery sustain a rich heritage of rock climbing. Recreation user groups use practices that decrease the likelihood of resource damage and abide by restrictions needed for wildlife protection. Ski Valley offers periodic snow based and other year-round recreation opportunities. The Arizona National Scenic Trail offers opportunities for hiking, cycling, and horseback riding across the ecosystem management area along a continuous north-south trending transect. The dark skies above the Santa Catalina Ecosystem Management Area present conditions conducive to astronomical research. Existing telescopes offer educational opportunities and promote scientific discovery.

Small stands of corkbark fir exist on cool, wet sites at the highest elevations. A complex assemblage of endemic pine trees exist in the Santa Catalina Ecosystem Management Area. Buehman Canyon retains the characteristics required to be designated an “Outstanding Arizona Water” by Arizona Department of Environmental Quality. Sabino Creek supports a diverse assemblage of native aquatic species. Habitat exists for bighorn sheep, Gould’s wild turkey, and Santa Catalina gray squirrel. Unique vegetation species are perpetuated in the Santa Catalina, Butterfly, and proposed Finger Rock Canyon Research Natural Areas. The unique values of Alder Canyon are perpetuated.

### Objective

1. Every 10 years treat vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 25 percent of the Santa Catalina Ecosystem Management Area to create resiliency to disturbances. Treatments will be consistent with the objectives for forestwide vegetation communities and resources.

### Standard

1. Within the Santa Catalina and Butterfly Peak Research Natural Areas, and the proposed Finger Rock Canyon Research Natural Area:
   a. Livestock grazing will not be permitted.
   b. Timber cutting is prohibited.
2. Within the Bighorn Sheep Management Area:
   a. Use of domestic sheep and/or goats for grazing or packing will not be permitted.

### Guidelines

1. During vegetation treatments, mesic microenvironments for woodland and talussnails endemic to the Santa Catalina Ecosystem Management Area (such as trees near rocky features, islands of shrubs within talus slopes, riparian colluvia, large logs, and scattered rocks on shady hillsides) should be protected.
2. Management activities involving ground disturbance, vegetation management, or both should incorporate site-specific design features to benefit habitat for, or mitigate impacts to rare or unique vertebrate, invertebrate and plant populations. For the Santa Catalina Ecosystem Management Area, these species include, but are not limited to:
   - Aravaipa woodfern,
   - Arizona eryngo,
   - Arizona manihot, and
   - Rusby's hawkweed

### Management Approaches

1. Developing a management plan for the Redington Pass Area in collaboration with the Friends of Redington pass and others.
2. Collaborating and working with partner groups such as Sabino Canyon Volunteer Naturalists, the Friends of Sabino Canyon, Sabino Mounted Patrol, and Sabino Canyon Bicycle Patrol.

# Chapter 5. Suitability

## Suitability of Uses and Special Use Permits

### Introduction

This section describes the appropriateness of applying certain resource management practices to a particular area of land. A unit of land may be suitable for a variety of individual or combined management practices. The land units considered in the suitability determinations are the land use zones and special areas, both described in chapters 3 and 4. Table 14 provides information on selected activities that may be allowed on the Coronado National Forest and is not inclusive of all activities that may be considered over the planning period. Existing special uses may be reauthorized where they are not suitable on a case-by-case basis, except for uses that are not suitable forestwide. Table 15 and table 16 show information on grazing capability and suitability and table 17 and table 18 show information on timber suitability and the suitability of activities that require special use permits issued by the Coronado National Forest. Definitions of special use permit categories can be found in the Forest Service Manual (FSM 2720 - Special Use Permit Administration). The analysis of suitability for all these uses can be found in the final environmental impact statement in topic 5 (Special Use Authorizations), and appendices C (Timber Suitability) and E (Range Suitability).

**Table 14. Suitability of selected activities by management areas**

| Suitable Uses | Wild Back-country | Roaded Back-country | Motorized Recreation | Developed Recreation | Wilderness Area, Wilderness Study Area, and Recommended Wilderness Area | Arizona National Scenic Trail | Research Natural Areas | Wet Canyon Talussnail Zoological Area | Mount Graham Astrophysical and Biological Research Area | Appleton-Whittell Research Ranch | Wild Chile Botanical Area |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Motorized access | Yes (Limited) | Yes | Yes | Yes | No | Adminis-trative only | No | Yes | No | Yes | Yes |
| Off-highway vehicle-focused recreation | No | No | Yes | No | No | No | No | No | No | No | No |
| Dispersed motorized camping | Yes | Yes | Yes | Yes | No | No | No | No | No | Yes | Yes |
| Recreation facilities | No | Yes | Yes | Yes | No | Yes | No | No | No | No | No |
| Timber harvest (for ecosystem restoration) | Yes | Yes | Yes | Yes | No | Yes | By exception[1] | Yes | Yes | Yes | Yes |
| Livestock grazing | Yes | Yes | Yes | No | Yes | Yes | By exception[2] | No | No | Yes | Yes |
| Forest products (commercial) | Yes | Yes | Yes | No | No | No | No | No | No | No | No |
| Forest products (traditional) | Yes | Yes | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes | Yes |
| Fuelwood products | Yes | Yes | Yes | Yes | No | No | No | No | No | Yes | Yes |

1. Only if allowed in the establishment record for the research natural area.
2. Only in established livestock grazing allotments.
3. Livestock grazing is generally not suitable in the Developed Recreation Land Use Zone except for approximately 12,206 acres within existing designated livestock grazing allotments.

# Grazing Capability and Suitability

## Introduction

Procedures in the 1982 Planning Rule require that the suitability and capability of National Forest System lands for producing forage for grazing animals be determined in forest planning. Suitability is the appropriateness of applying certain resource management practices to a particular area of land in consideration of the relevant social, economic, and ecological factors. Capability is the potential of an area of land to produce resources and supply goods and services. Capability depends upon current conditions and site conditions such as climate, slope, landform, soils, and geology.

The capability of Coronado National Forest lands to produce forage for grazing animals was determined in the 1980s for the 1986 forest plan. Landscape scale conditions that determine capability (such as landform, geology, slope, and climate) have not changed significantly since the first evaluation; therefore, capability determined in the original analysis is still applicable. Cyclical or temporal fluctuations in climatic conditions such as El Niño cycles or drought periods are not cause for reanalyzing capability, but are considered by Coronado National Forest staff when making project level grazing decisions and responded to through adaptive management. Current climate conditions and trends have not been shown to be outside of historical norms for the Southwest. What has changed since the original analysis is the availability of more accurate data and analysis tools. Capability for this plan was reassessed using corporate GIS data.

The Coronado National Forest constrains capability of lands for producing forage for livestock based on slope (less than 40 percent) and forage productivity (more than 100 pounds per acre per year). Forage productivity is not currently mapped at a scale fine enough to detect areas with less than 100 pounds per acre per year, and so capability is identified and mapped using slope as the sole criteria. However, lands with slopes greater than 40 percent are intermingled throughout grazing allotments and livestock will intermittently utilize these lands as they pass through them while traveling to other capable portions of the allotments. This intermittent use may, and often does, contribute in a limited way to the forage base for domestic livestock. The results of the analysis are displayed in table 15.

**Table 15. Grazing capability calculations for the Coronado National Forest**

| Grazing Capability Analysis | Acres |
|---|---|
| Gross Area of the Coronado National Forest | 1,783,934 |
| Slopes Greater than 40% | 719,999 |
| Lands tentatively capable for livestock grazing | 1,063,935 |

Suitability is determined based on compatibility with desired conditions and objectives in the plan area. Lands within the plan area are not identified as suitable for a certain use if that use is prohibited by law, regulation, or policy; would result in substantial and permanent impairment of the productivity of the land or renewable resources; or if the use is incompatible with the desired conditions for the relevant portion of the plan area. The determination of an area as suitable for a particular use does not mean that the use will occur over the entire area. Likewise, a determination that a particular use is not suitable in a management area does not mean that the use will not occur in specific areas. The identification of an area as suitable for various uses is *guidance* for project and activity decisionmaking and is *not a resource commitment or final decision* approving projects and activities. Final decisions on resource commitments are made at

the project level. The final decision to authorize livestock grazing would be made at a project (allotment) level.

Suitability determinations for livestock grazing are consistent with desired conditions, objectives, standards, and guidelines for the various management areas described in this plan. Management areas determined to be suitable for livestock grazing range in size from 786 acres to almost 600,000 acres, and all contain both capable and not-capable lands due to the complex topography of the Coronado National Forest. Table 16 identifies those areas of the Coronado that are not suitable for livestock grazing. Of the approximately 1,063,935 acres identified as tentatively capable for livestock grazing, 47,708 acres were identified as not suitable due to incompatibility with desired conditions. See "Appendix E. Range Suitability" in the accompanying environmental impact statement for a description of the range suitability evaluation process.

**Table 16. Areas not suitable for grazing on the Coronado National Forest**

| Management Area | Acres |
|---|---|
| Developed Recreation* | 36,774 |
| Elgin Research Natural Area | 245 |
| Goudy Canyon Research Natural Area and proposed extension | 558 |
| Canelo Research Natural Area | 386 |
| Santa Catalina Research Natural Area | 634 |
| Butterfly Research Natural Area | 1,058 |
| Proposed Finger Rock Research Natural Area* | 1,103 |
| Wet Canyon Talussnail Area | 1,218 |
| Mount Graham Astrophysical and Biological Research Area | 2,937 |
| Pole Bridge Research Natural Area and proposed extension | 582 |
| Goodding Research Natural Area and proposed extension | 2,213 |
| **Total area of Management Areas determined to be not suitable for Livestock Grazing** | 47,708 |
| **Tentatively capable lands that are not suitable for livestock grazing due to incompatibility with desired conditions.** | 31,730 |

* Livestock grazing is generally not suitable in the Developed Recreation Land Use Zone except for approximately 12,206 acres within existing designated livestock grazing allotments.

## Timber Suitability

The National Forest Management Act of 1976 requires that National Forest System lands be classified as to their suitability for various uses, including timber production. National Forest System lands were reserved with the intent of providing goods and services to satisfy public needs over the long-term, among them is a sustainable supply of forest products. The 1982 Planning Rule provisions require the Responsible Official to identify lands not suitable for timber production within the area governed by the forest plan (36 CFR 219.14).

Forest Service Manual (FSM) 1900 defines “forest land” as that which has at least 10 percent tree cover, or which had such tree cover in the past, and which is not currently developed for nonforest uses, such as agriculture, providing improved pasture, residential or administrative areas, improved roads of any width, and adjoining road clearing and powerline clearing of any width. It defines timber production as “the purposeful growing, tending, harvesting, and regeneration of regulated crops of trees for cutting into logs, bolts, or other round sections for industrial or consumer use.”

Forest land may be considered as “unsuitable” for timber production if any of the following apply:

(a) Congress, the Secretary, or the Chief has withdrawn it from the public domain,

(b) it is not producing or capable of producing crops of industrial wood,

(c) there is no technology available to prevent irreversible damage to soil productivity and/or watershed conditions;

(d) there is no reasonable assurance based on existing technology and knowledge, that it is possible to restock lands within five years after final harvest, as reflected in current research and experience;

(e) there is currently a lack of adequate information about responses to timber management activities; and/or

(f) timber management is inconsistent with, or not cost-efficient in meeting, the management requirements, and multiple-use objectives specified in the forest plan.

Table 17 shows the results of a timber suitability analysis for the Coronado. In the table, various categories of forest land are described, and the acres suitable (or unsuitable, negative numbers) for timber production are reported. See FEIS, Volume 2, Appendix C for the full timber suitability analysis.

Lands having potential commercial-grade timber are located at very high elevations of mountain ranges on four ranger districts. These areas are isolated and difficult to access, making it extremely unlikely for a single processing facility to develop a feasible business model that could incorporate most timbered lands. None of the ranges contains more than 15,000 acres of commercial-grade timber, and most contain much less. Even within each range, timber lands are often separated by major topographic features and/or have little or no road access.

**Table 17. Timber suitability assessment of Coronado National Forest lands**

| Category | Description | Acres |
|---|---|---|
| Coronado National Forest (total land) | All acreage comprising the national forest | 1,778,077 |
| Non-forested lands | Non-forested (less than 10% occupied by forest trees) | –1,538,340 |
| Lands withdrawn from public domain | Designated wilderness areas, inventoried roadless areas, and private ownership | –180,171 |
| Lands having irretrievable resource damage | Lands having a 40% or higher slope and posing a severe erosion hazard | –1,496 |
| Lands where there is no assurance of adequate stocking | General ecosystem survey shows low stocking | –12,413 |
| Lands tentatively suitable for timber production | | 45,657 |
| Recommended as wilderness areas | Acres not already substracted above | -55 |
| Not cost efficient in meeting timber production objectives | Located in the Santa Rita, Huachuca, Pinaleño, Santa Catalina, and Chiricahua Ecosystem Management Areas | –45,602 |
| Land suitable for timber production | | 0* |
| Land not suitable for timber production | | 1,778,077 |

* Because the Coronado National Forest has zero acres suitable for timber production, the long-term sustained yield calculation (LTSYC) and allowable sale quantity (ASQ) are zero as well.

## Lands and Special Uses

Data and information related to the use of Coronado National Forest lands for permitted special uses were obtained from the Forest Service special uses database, Coronado Geographic Information System (GIS) database, special use program records and permit files, and Federal, State, and local databases. The special uses database provided the legal coordinates of various special use areas to determine the compatibility of current use with recommended new wilderness and other special areas.

The special uses database provided the type, number, and status of special use authorizations on the Coronado National Forest. Some use codes were combined into the general categories listed in Forest Service Handbook 27091.11, “Chapter 50 – Terms and Conditions Use Chart.” Current special use authorizations were tallied for applications approved, pending signature, and to be issued contemporaneously with preparation of this plan. Inaccuracies in the database tally include accounting for permits that have expired but remain reported as issued and may not be reissued or closed, and expired permits for which uses are ongoing but are currently not authorized or counted. Short-term permits are not separated from long-term permits in the total authorizations.

Various acreages and miles of specific features were obtained from the Coronado GIS database. Reviews of private property in relation to proposed wilderness and other special areas used information and data from the counties in which the Districts are located and the Coronado GIS land ownership files.

Suitability of lands on the Coronado for various special uses was determined primarily based on revised plan direction for specific management areas and staff on-the-ground experience with over 40 years of special uses administration experience. Each special use was also evaluated relative to the needs of the public user and resource conditions in each management area.

The columns in table 18 show the suitability of specific management areas for select special use categories. Energy corridors are linear strips of land identified for the present or future location of a utility right-of-way (such as above- or below-ground electric transmission line, gas pipeline). Other energy

developments include the infrastructure associated with the provision or transport of energy (such as dams, biomass power generation, wind turbines, and solar panels). Communication sites acceptable on National Forest System lands used are identified in appendix C. Motorized outfitter-guide uses are conducted by various types of vehicles and include hunting, fishing, and ecotours for wildlife viewing. Military training includes tracking classes, frequency testing, unmanned aerial vehicle use and testing, and downed pilot search and rescue. Treasure trove is the exploration for buried treasure. Department of Homeland Security, Customs and Border Protection uses includes foot, equestrian, vehicular and aerial patrols; vehicle mounted camera deployment, and forward operating camps.

**Table 18. Suitability of select special uses on the Coronado National Forest**

| Management Area | Energy Corridor | Other Energy | Comm. Site[1] (Excl. DHS)[6] | Motorized Outfitting & Guiding | Military Training | Recreation Event | DHS/CBP Activities[6] |
|---|---|---|---|---|---|---|---|
| Wild Backcountry | Not suitable | Not suitable | Suitable[1] | Not suitable | Suitable | Suitable | Suitable[3] |
| Roaded Backcountry | Suitable | Suitable | Suitable[1] | Suitable | Suitable | Suitable | Suitable |
| Motorized Recreation | Suitable | Suitable | Not suitable | Suitable | Suitable | Suitable | Suitable |
| Developed Recreation | Not suitable | Not suitable | Suitable[1] | Not suitable | Not suitable | Not suitable | Suitable |
| Wilderness Area, Wilderness Study Area, and Recommended Wilderness Area | Not suitable | Not suitable | Not suitable | Not suitable | Not suitable | Suitable[2] | Suitable[3] |
| Arizona National Scenic Trail (within 1/2 mile)[5] | Not suitable | Not suitable | Not suitable | Not suitable | Not suitable | Suitable[2] | Suitable[3, 4] |
| Research Natural Areas | Not suitable | Not suitable | Not suitable | Not suitable | Suitable | Suitable[2] | Suitable[4] |
| Wet Canyon Talussnail Zoological Area | Not suitable | Not suitable | Suitable[1] | Not suitable | Not suitable | Suitable[2] | Suitable[4] |
| Mount Graham Astrophysical and Biological Research Area | Not suitable | Not suitable | Not suitable | Not suitable | Not suitable | Not suitable | Suitable[3, 4] |
| Appleton-Whittell Research Ranch | Not suitable | Not suitable | Not suitable | Not suitable | Suitable | Suitable[2] | Suitable[4] |
| Wild Chile Botanical Area | Not suitable | Not suitable | Not suitable | Not suitable | Not suitable | Suitable[2] | Suitable[4] |

1. Communication uses at approved sites only, excluding Department of Homeland Security
2. Approved on a case-by-case basis
3. Nonmotorized use only, helicopter landings at authorized sites.
4. No forward operating camps.
5. Uses that will not substantially interfere with the nature and purposes of the trail.
6. DHS/CBP = Department of Homeland Security/Customs and Border Protection

# Chapter 6. Monitoring and Evaluation

## Introduction

Monitoring and evaluation are separate and sequential activities required by National Forest Management Act regulations to determine how well the forest plan is working. Monitoring[42] involves collecting data by observation or measurement. Evaluation involves analyzing and interpreting monitoring data.

Monitoring and evaluation activities provide ongoing feedback about management effectiveness and are essential elements of an adaptive management cycle that includes problem identification, solution, and implementation. Monitoring and evaluation activities keep direction found in the forest plan up to date and relevant by being responsive to changing conditions and issues—including public desires—and to new information, such as research results or outcomes from management activities.

The 2012 Planning Rule requires that forest plans developed under prior planning regulations, including the 1982 Planning Rule, follow the updated 2012 rule guidance on the required content in the monitoring plan. The Coronado developed its plan monitoring program consistent with the requirements of the 1982 rule, but also with an eye towards meeting the 2012 rule monitoring requirements. A monitoring program, consistent with 2012 rule monitoring requirements, is to contain one or more monitoring questions and associated indicators addressing the following monitoring categories:

1. The status of select watershed conditions;
2. The status of select ecological conditions, including key characteristics of terrestrial/aquatic ecosystems;
3. The status of focal species to assess ecological conditions;
4. The status of a select set of ecological conditions that contribute to the recovery of threatened and endangered species, conserve proposed and candidate species, and maintain a viable population of species of conservation concern;
5. The status of visitor use, visitor satisfaction, and progress toward meeting recreation objectives;
6. Measurable changes on the plan area related to climate change and other stressors;
7. Progress toward meeting desired conditions and objectives (including those for multiple uses);
8. The effects of management systems so that they do not substantially and permanently impair the productivity of the land;
9. The plan contributions to communities, social and economic sustainability of communities, and multiple uses of the plan.

[42] The general purpose of monitoring is to detect changes or trends in a resource. Detection of a change or trend may trigger a management action, or it may generate a new line of inquiry. Monitoring data are most useful when the same methods are used to collect data at the same locations over time. It is important to note that cause-and-effect relationships usually cannot be demonstrated with monitoring data, but monitoring data might suggest a cause-and-effect relationship that can then be investigated with a research study.

The majority of the nine items listed above are addressed in the plan monitoring and evaluation table on the pages that follow. Two 2012 rule requirements, that are not requirements of the 1982 rule, are not directly addressed: species of conservation concern and focal species. Item 4 of the above list requires that plan monitoring be consistent with 2012 rule monitoring requirements to monitor a "select set of ecological conditions" to maintain viable species of conservation concern populations. The monitoring identified in the table that follows does monitor a "select set of ecological conditions" but for the purposes of maintaining the viability of the Coronado's 1982 rule "planning species." Planning species are a much larger set of species than species of conservation concern, with those species that would be considered species of conservation concern being a subset contained within the planning species set. In addition, focal species (item number 3 above) are a 2012 rule monitoring concept, not part of the 1982 rule requirements and thus not currently included in the plan monitoring table. Soon after the revised Coronado plan is approved, a monitoring transition process will be undertaken to identify focal species that should be part of the Coronado plan monitoring requirements.

## Monitoring Strategy

A strategy for forest plan monitoring and evaluation has been designed to answer these three basic questions:

**Did we do what we said we were going to do?** This question answers how well the direction in the forest plan is being implemented. Collected information is compared to objectives, standards, and guidelines.

**Did it work how we said it would?** This question answers whether the application of standards and guidelines is achieving objectives, and whether objectives are achieving desired conditions.

**Is our understanding and science correct?** This question answers whether the assumptions and predicted effects used to formulate the desired conditions and objectives are valid.

The following guiding principles are key elements of the monitoring strategy and serve as a framework for implementing an effective monitoring and evaluation program:

- Monitoring efforts are efficient, practical, and affordable, make use of the best available science, and do not duplicate the collection of data already underway for other purposes.
- Monitoring tasks are scaled to the desired condition, objective, or management area direction to be monitored.
- Monitoring is not performed on every single activity, nor does it need to meet the statistical rigor of formal research.
- A monitoring action plan is prepared each year to identify specific items that should be monitored in the coming year. The annual monitoring action plan identifies and schedules various site-specific, on-the-ground monitoring activities. It also describes the methods, locations, responsible persons, and estimated costs.
- Budgetary constraints may affect the level of monitoring that can be done in a particular fiscal year. If budget levels limit the Coronado National Forest's ability to perform all monitoring tasks, then those items specifically required by law are given the highest priority.
- Opportunities to complete monitoring and evaluation activities through partnerships and citizen collaboration are examined on a regular and ongoing basis.

- A monitoring and evaluation report is prepared each year that summarizes the results of completed monitoring and evaluates the data for indicators of trends or effects.
- The forest supervisor annually evaluates the monitoring information displayed in the evaluation reports through a management review and determines if any changes are needed in management actions or the forest plan itself.
- The public is given timely, accurate information about forest plan implementation. This is done through the release of the annual monitoring and evaluation report.

In some cases, the monitoring question directly assesses accomplishment of desired conditions. In other cases, they gauge objectives or guidelines associated with the desired conditions.

For each monitoring question or performance measure listed in table 19, additional monitoring descriptors are included to provide context for the type of information to gather and how often to gather it. These descriptors are defined here:

**Possible Monitoring Methods and Data Sources:** The type of data that may be used to answer the question. Forest plan monitoring data collection can include methods that:

- generally are well accepted for modeling or quantitative measurement and have a high degree of accuracy and precision; or
- methods or measurements that are based on project records, personal communications, visual estimates, informal visitor surveys, and similar types of assessments that are more qualitative and less precise.

**Frequency of Monitoring:** Describes how often information is gathered or measured such as annually, every 5 years, or every 10 years.

**Table 19. Monitoring and evaluation**

| Resource Area | Monitoring Question | Possible Monitoring Methods and Data Sources | Frequency of Monitoring (Years) | Monitoring Category |
|---|---|---|---|---|
| Desert and Grassland Communities | How has the distribution of non-native invasive grasses changed? Have changes in climate affected the spread of invasive grasses to new niches? | Monitor total infestation acres and treatment acres; climate data and interpretation from research partners | 2 | 6. Climate Change<br>7. Plan Components |
| Grassland Communities, Interior Chaparral, Madrean Encinal Woodland, Madrean Pine-Oak Woodland, Ponderosa Pine-Evergreen Shrub | At the mid-scale, is the percent of uplands in open canopy states appropriate for the potential natural vegetation types present? | Midscale vegetation, FACTs, RAV, interpretation of aerial photography - Percent acres in open canopy (consider using 5th-code watersheds for scale). | 5 | 1. Watershed Conditions<br>7. Plan Components |
| Forestwide Vegetation – All Types | How has the scale and severity of disturbance (such as wildfires, insects, and disease) and vegetative response to these disturbances demonstrated changes in wildland ecosystems due to climate change across the Coronado? | Fire regime condition class, forest health surveys and reports, stand exams, project inspections and reviews, remote sensing, incident mapping for wildfires, large fire occurrence map, rangeland health assessments, surveys, and reports. | 1-5 | 6. Climate Change |
| Wet and Dry Mixed Conifer | The Mexican spotted owl is identified as a management indicator species in these vegetation communities. At the project level, are stand post-treatment conditions consistent with or moving toward desired conditions for coarse woody debris, large diameter trees, and snags? How have populations and distributions of Mexican spotted owl changed? | Post-treatment monitoring of habitat elements, Mexican spotted owl monitoring. | 1 | 4. Species Viability |
| Ponderosa Pine-Evergreen Shrub, Dry and Wet Mixed Conifer, Spruce-fir | How many acres are predicted to support active crown fire as modeled under typical peak fire danger conditions at the midscale? | LANDFIRE, BEHAVE modeling | 5 | 4. Species Viability<br>6. Climate Change<br>7. Plan Components |
| Madrean Encinal Woodland | What percent of the understory community is formed by the groups of native grasses, grasslike species, forbs, and shrubs appropriate to the ecological site description units or terrestrial ecosystem units? | Rangeland health monitoring | 5 | 1. Watershed Conditions<br>7. Plan Components |

| Resource Area | Monitoring Question | Possible Monitoring Methods and Data Sources | Frequency of Monitoring (Years) | Monitoring Category |
|---|---|---|---|---|
| Madrean Pine-Oak Woodland | The acorn woodpecker is identified as a management indicator species in the Madrean pine-oak woodland. How have populations and distribution of acorn woodpeckers changed? | Population: numbers; distribution: via habitat. | 5 | 2. Terrestrial and Aquatic Habitat |
| Soil | Are long-term soil health and productivity measures at or moving towards desired conditions? | Rangeland health soil condition assessments of effective ground cover from litter and plants and evidence of erosion | 3-5 | 1. Watershed Conditions<br>7. Plan Components<br>8. Productivity |
| Watersheds | What projects have been implemented to improve watershed conditions? | Number of projects implemented annually | 1 | 1. Watershed Conditions |
| Riparian Areas | Are riparian areas on the Coronado National Forest at or moving toward desired conditions? | RASES transects (approximately 97) | 10 | 1. Watershed Conditions<br>2. Terrestrial and Aquatic Habitat<br>7. Plan Components |
| Natural Water Sources | Are springs and streams showing a decrease in water availability due to increases in air temperature, an increase in extreme weather events, and increased drought? | Instream gauge flow data; climatic data including average daily and monthly temperatures, precipitation amount, distribution, and intensity; wet and dry stream segment assessments; water source inventory | 5 | 1. Watershed Conditions<br>2. Terrestrial and Aquatic Ecosystems<br>6. Climate Change |
| Natural Water Sources, Constructed Waters | What has been the change in distribution and relative abundance of American bullfrogs? | Acres of habitat and number places where American bullfrogs occur. | 5 | 2. Terrestrial and Aquatic Habitat<br>4. Species Viability |
| Natural Water Sources, Constructed Waters | The Sonoran mud turtle is identified as a management indicator species in natural and constructed water sources and can be found in the grasslands, Madrean encinal woodlands, and Madrean pine-oak woodlands vegetation communities. How have populations and distribution of Sonoran mud turtles changed? | Acres of habitat and number places where Sonoran mud turtles occur. | 5 | 2. Terrestrial and Aquatic Habitat |
| Natural Water Sources | How many stream or spring restoration projects have been completed for the benefit of species of conservation concern? | Track project workplans for natural water source restoration projects. | 2 | 1. Watershed Conditions<br>4. Species Viability |
| Constructed Waters | Are there bat escape ramps on elevated artificial water sources? | Track grazing allotment inspection reports. | 2 | 4. Species Viability |

| Resource Area | Monitoring Question | Possible Monitoring Methods and Data Sources | Frequency of Monitoring (Years) | Monitoring Category |
|---|---|---|---|---|
| Public Access | How many permanent access roads and trails have been established through resolution of legal status deficiencies? | Track access establishments in lands records. | 5 | 5. Recreation<br>7. Plan Components |
| Land Ownership Adjustments and Boundary Management | How many acres of non-Federal land within the property lines of the Coronado National Forest have been acquired? | Track acres acquired in lands records. | 5 | 7. Plan Components |
| Recreation | Is the Coronado National Forest providing high quality and sustainable recreation opportunities? Is the Coronado National Forest meeting public recreation demand according to indicators and visitor satisfaction surveys? | NVUM and other visitor surveys, INFRA data, and qualitative assessments. | 5 | 5. Recreation<br>7. Plan Components |
| Scenic Quality | What are the impacts and improvements to scenic quality across the Coronado National Forest? | Existing scenic integrity inventories and qualitative assessments. | 10 | 7. Plan Components |
| Range | What number of livestock are being authorized to graze on the Coronado each year to be in balance with forage supplies? | Range billing information | 1 | 9. Social & Economic Sustainability |
| Cultural Resources | Are cultural resources being protected? | Stabilization or preservation activities conducted | 3-5 | 9. Social & Economic Sustainability |
| Special Uses | How many special use permits are being issued or renewed each year for events and activities on the Coronado? | Special use databases | 1 | 9. Social & Economic Sustainability |

# Glossary

**Accuracy:** is a measure of how close a measurement is to the actual value of the variable being measured. Example: a land surveyor collecting survey grade data for a project will have high accuracy and be close to a perfect match to what is actually on the ground.

**Administrative use:** Use by the Forest Service.

**Air quality related values:** A feature or property of an area that is affected in some way by air pollution. Identified values are visibility, odor, flora, fauna, soil, water, geologic feature, and cultural resources.

**Ancillary uses:** a subsidiary use connected to the main use of a building or a piece of land.

**Aquatic:** Relating to water; living in or near water; taking place in water; opposite of terrestrial.

**Aquifer:** Rock or soil bodies that store and transmit ground water in economic quantities.

**Basal area:** The cross-sectional area at breast height (4.5 feet above the ground) of trees measured in square feet. Basal area is a way to measure how much of a site is occupied by trees. The cross-sectional area is determined by calculating the tree's radius from its diameter (diameter÷2 = radius) and using the formula for the area of a circle ($\pi$ x radius$^2$ = cross-sectional area). Basal area per acre is the summation of the cross-sectional area of all trees in an acre or in a smaller plot used to estimate basal area per acre. Diameter at root collar (the part of a tree where the main roots join the trunk, usually at or near ground level) is used to calculate the cross-sectional area of multi-stemmed trees such as juniper and oak.

**Cave:** Any naturally occurring void, cavity, recess, or system of interconnected passages that occurs beneath the surface of the Earth or within a cliff or ledge, including any cave resource therein, but which is large enough to permit an individual to enter, whether the entrance is naturally formed or manmade. Such a term must include any natural pit, sinkhole, or other feature that is an extension of the entrance.

**Cave resource:** Any material or substance occurring in caves, including but not limited to those that are biotic, cultural, mineralogic, paleontologic, geologic, and hydrologic.

**Biomass:** see "woody biomass"

**Class I airshed:** An airshed classification where areas require the highest level of protection under the Clean Air Act of 1963.

**Class II airshed:** An airshed classification representing National Forest System land that is not classified as a class I airshed. These areas may receive a greater amount of manmade pollution than class I areas.

**Clump:** A tight cluster of two to five trees of similar age and size originating from a common rooting zone that typically lean away from each other when mature. A clump is relatively isolated from other clumps or trees within a group of trees, but a stand-alone clump of trees can function as a tree group.

**Coarse woody debris:** Woody material, including logs, on the ground greater than 3 inches in diameter; a component of litter. Large coarse woody debris is often considered downed logs at least 12 inches in diameter and 8 feet in length.

**Colluvium (colluvia *plural* ):** a heterogeneous mixture of soil and debris that accumulates, typically at the base of a slope, as a result of mass wasting, overland flow, sheet erosion, freeze-thaw cycles, or other erosional processes.

**Concern level:** A measure of degree of public importance placed on landscapes (scenery) viewed from travelways (roads and trails) and use areas. There are three levels: concern level 1 (high), concern level 2 (moderate), and concern level 3 (low).

**Communications site:** An area of National Forest System land used for telecommunications services. A communications site may be limited to a single communications facility, but most often encompasses more than one facility.

**Connectivity:** The arrangement of habitats that allows organisms and ecological processes to move across the landscape; patches of similar habitats are either close together or linked by corridors of appropriate vegetation; the opposite of fragmentation.

**Declining:** The senescent (aging) period in the lifespan of plants that includes the presence of dead or dying limbs, snag tops, and other characteristics that indicate the later life stages of vegetation.

**Defensible space:** An area either natural or manmade where material capable of allowing a fire to spread has been treated, cleared, reduced, or changed to act as a barrier between an advancing wildland fire and property or resources. In practice, "defensible space" is defined as an area a minimum of 30 feet around a structure that is cleared of flammable brush or vegetation.

**Developed recreation site:** A distinctly defined area where facilities are provided by the Forest Service for concentrated public use (such as campgrounds and picnic areas).

**Diameter:** The diameter of a tree species, usually measured by two primary methods:

- Diameter at breast height (d.b.h.): The diameter of a tree at the bole (or trunk) typically measured at 4.5 feet above ground level.
- Diameter at root collar (d.r.c.): The diameter of a woodland tree species typically measured at the root collar (the part of the tree where the main roots join the trunk, usually at or near ground level) or at the natural ground line, whichever is higher.

**Dispersed motorized camping:** Camping with motorized vehicles outside of developed campsites.

**Dispersed recreation:** Outdoor recreation in which visitors are spread over relatively large areas outside developed recreation sites. Where facilities or developments are provided, they are more for access and protection of the environment than for the comfort or convenience of the visitors.

**Ecosystem management area (EMA):** Unique geographic areas based on the major mountain ranges that make up the Coronado National Forest (see map on page 3).

**Ecosystem:** A spatially explicit, relatively homogeneous unit of the Earth that includes all interacting organisms and components of the abiotic environment within its boundaries. An ecosystem is commonly described in terms of its: (1) composition—major vegetation types, rare communities, aquatic systems, and riparian areas; (2) structure—successional stages, water quality, wetlands, and flood plains; (3) function—ecological processes such as streamflows and disturbance regimes.

**Ecosystem services:** Ecosystem services are benefits that people obtain from ecosystems. The Coronado National Forest provides: (1) services such as food, fresh water, fuel, and fiber; (2) regulating services such as climate, air quality, water pollination, disease regulation, and a diverse wildlife habitat; (3) supporting services such as soil formation and nutrient cycling; and (4) cultural services such as educational, aesthetic, and cultural heritage values as well as recreation and tourism opportunities.

**Even-aged:** A stand or group of trees composed of a single age class in which the range of tree ages is usually less than 40 years, or in which the range of tree ages is within 20 percent of the mean tree age, whichever is greater.

**Federally listed species:** Threatened or endangered species listed under the Endangered Species Act (ESA) of 1973, as amended.

**Fire regime:** The patterns, frequency, and severity of fire that occur over a long period of time across a landscape and its immediate effects on the ecosystem in which it occurs. There are five fire regimes that are classified based on frequency (average number of years between fires) and severity (amount of replacement of the dominant overstory vegetation) of the fire. These five regimes are:

**Fire Regime I:** 0- to 35-year frequency. Generally low-severity fires replacing less than 25 percent of the dominant overstory vegetation; can include mixed-severity fires that replace up to 75 percent of the overstory.

**Fire Regime II:** 0- to 35-year frequency. High-severity fires replacing greater than 75 percent of the dominant overstory vegetation.

**Fire Regime III:** 35- to 200-year frequency. Generally mixed severity; can also include low-severity fires.

**Fire Regime IV:** 35- to 200-year frequency. High-severity fires.

**Fire Regime V:** 200+ year frequency. Generally replacement severity; can also include any severity type in this frequency range.

**Fire Severity:** In fire regime methodology, this is the effect of fire in terms of upper layer canopy replacement. The severity classes are:

**Low:** 6 to 25 percent replacement

**Mixed:** 26 to 75 percent replacement

**High/Replacement:** More than 75 percent replacement

**Forest product:** Plants or plant part harvested under a forest products permit or contract.

**Firewood products:** Wood removed for firewood.

**Geographic area:** Areas of the Coronado National Forest that have their own distinct characteristics and conditions reflected in geographic area specific plan components. The Coronado National Forest is divided into 12 geographic areas.

**Geology/geologic:** The study of the Earth, including all its subdisciplines, such as historical geology, mineralogy, paleontology, seismology, geomorphology, speleology, structural geology, hydrogeology, and so forth.

**Geomorphology:** The study of classification, description, nature, origin, and development of present landforms and their relationships to underlying structures, and of the history of geologic changes as recorded by these surface features. Geomorphology has three primary components: geomorphic process, landform, and morphometry.

**Geomorphic process:** The dominant internal or external geologic force that has interacted with the existing geologic structural framework to shape the Earth’s surface at a given location or area.

**Goshawk foraging areas:** The areas that surround goshawk post-fledging family areas that northern goshawks use to hunt for prey. They are approximately 5,400 acres and do not include the post-fledging family area or nesting area acres.

**Goshawk nest areas:** The areas immediately around a nest that are used by northern goshawks in relation to courtship and breeding activities. They are approximately 30 acres and contain multiple groups or patches of large, old trees with interlocking crowns.

**Goshawk post-fledging family areas:** The areas that surround nest areas. They represent an area of concentrated use by the northern goshawk family until the time the young are no longer dependent on adults for food. Post-fledging family areas are approximately 420 acres, not including the nest area.

**Grass reserve:** An area that is normally not allocated for livestock grazing, although it may be used when an authorized pasture or allotment is unavailable.

**Group:** A cluster of two or more trees with interlocking or nearly interlocking crowns at maturity surrounded by an opening. Size of tree groups is typically variable depending on forest type and site conditions and can range from fractions of an acre (a two-tree group) to many acres. Trees within groups are typically not uniformly spaced, some of which may be tightly clumped.

**Herbivory:** Loss of vegetation due to consumption by another organism.

**Historic range of variation (HRV):** A description of the change over time and space in the characteristic ecological conditions of potential natural vegetation types and the ecological processes that shape those types.

**Hydrologic unit code (HUC):** The United States is divided and subdivided into successively smaller hydrologic units that are classified into four levels: regions, subregions, accounting units, and cataloging units. The hydrologic units are arranged or nested within each other, from the largest geographic area (regions) to the smallest geographic area (cataloging units). Each hydrologic unit is identified by a unique hydrologic unit code consisting of two to eight digits based on the four levels of classification in the hydrologic unit system.

**Instream flow:** Streamflows needed for maintaining wildlife, visual quality, and recreational opportunities at an acceptable level. Aquatic and riparian ecosystems through maintenance of channels and flood plains also benefit.

**Invasive species:** Alien (nonnative) species whose introduction does, or is likely to cause economic or environmental hardship to human health (Executive Order 13112).

**Karst:** Terrain created by the chemical solution of the bedrock, including carbonate rocks, gypsum, and to a minor extent on other rocks, and characterized by disrupted surface drainage, abundant enclosed depressions, and a well-developed system of underground drainage systems, which may include caves. The term “pseudokarst” is sometimes used to distinguish karst terrain formed on noncarbonate bedrock.

**Karst resources:** The elements of a karst landscape, commonly characterized by losing streams, sinkholes, collapse features, caves, or springs. These may not only be physical features, but may also relate to karst groundwater systems, system(s) function, and biological significance to the vegetative, wildlife, and aquatic communities.

**Landform:** Any physical feature of the Earth’s surface having a characteristic recognizable shape and produced by natural causes directly linked to geomorphic process.

**Leave No Trace:** Guidelines that help protect the land and lessen the sights and sounds of forest visitors (http://www.lnt.org/).

**Litter:** Litter consists of dead, unattached organic material on the soil surface that is effective in protecting the soil surface from raindrop splash, sheet and rill erosion, and is at least ½ inch thick. Litter is composed of leaves, needles, cones, and woody vegetative debris including twigs, branches, and trunks.

**Livestock grazing:** Use of forage by domestic livestock under a livestock-grazing permit in a designated grazing allotment.

**Locatable minerals:** Minerals that may be located and removed from Federal lands under the General Mining Law of 1872 as amended and were not excepted in later legislation. They include hard rock, placer and industrial minerals, and uncommon varieties of rocks found on public domain lands. This category includes gold, silver, manganese, copper, and other valuable deposits specifically named in the law. Later regulatory acts removed certain mineral and energy resource from the locatable classification.

**Mastication:** Mechanical fuel treatment that changes the structure and size of fuels by grinding, shredding, chopping, or chipping.

**Mechanical treatments:** Those projects involving the use of anything motorized such as chainsaws, dozers, mastication, or chippers.

**Metapopulation:** A set of partially isolated populations belonging to the same species that can interbreed and recolonize areas where the species has recently become locally extinct.

**Middens:** Red squirrel middens are accumulations of cone scales and debris left by feeding; middens may last several years and provide winter refugia.

**Mineral materials:** Earth construction materials that are not considered locatable under Federal mining laws or leasable under Federal mineral leasing laws. They include common varieties of rock or stone, sand and gravel, pumice aggregate, pumicite, cinders, and soil materials suitable for compacted Earth structures, landscaping, and other uses.

**Morphometry:** The measurement and mathematical analysis of the configuration of the Earth's surface and of the shape and dimensions of landforms. Morphometry is used to quantify the land surface and further describe the variability in landforms. Morphometric parameters such as relief, elevation, aspect, slope gradient, slope position, slope shape, slope complexity, landform width, dissection frequency, dissection depth, drainage pattern, and drainage density can be used to predict changes in slope hydrology, soils, and plant communities.

**Motorized access (motorized routes):** Use of motorized vehicles on National Forest System roads or trails that are designated for motor vehicle use.

**National Forest System:** As defined in the Forest Rangeland Renewable Resources Planning Act, the "National Forest System" includes all national forest lands reserved or withdrawn from the public domain of the United States, all national forest lands acquired through purchase, exchange, donation, or other means; the national grasslands and land use projects administered under Title III of the Bankhead-Jones Farm Tennant Act (50 Stat. 525, 7 U.S.C. 1010-1012); and other lands, waters, or interests therein administered by the Forest Service or are designated for administration through the Forest Service as part of the system.

**Off-highway vehicle-focused recreation:** Facilities, routes, or events specifically for off-highway vehicle users.

**Old growth:** Old growth in southwestern forested ecosystems is different from the traditional definition based on northwestern infrequent fire forests. Due to large differences among Southwest forest types and natural disturbances, old-growth forests vary extensively in tree size, age classes, presence, and abundance of structural elements, stability, and presence of understory. Old growth refers to specific habitat components that occur in forests and woodlands—old trees, dead trees (snags), downed wood (coarse woody debris), and structure diversity. These important habitat features may occur in small areas with only a few components, or over larger areas as stands or forests where old growth is concentrated. In the Southwest, old growth is considered "transitional," given that the location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality). Some species, notably certain plants, require "old forest" communities that may or may not have old-growth components but have escaped significant disturbance for lengths of time necessary to provide the suitable stability and environment.

**Openings:** Spatial breaks between groups or patches of trees, as large or larger than groups, that contain grass, forb, shrub, and/or tree seedlings but are largely devoid of big trees, with a total tree cover of less than 10% in openings.

**Paniculate Agave:** Species in the subgenus Agave having a branched inflorescence with flowers born in umbellate cluster on lateral branches.

**Patches:** Areas larger than tree groups in which the vegetation composition and structure are relatively homogeneous. Patches comprise the mid-scale, thus they range in size from 10 to 1,000 acres.

**Planning period:** The life of the forest plan, generally 10 to 15 years from plan approval.

**Precision:** Precision refers to how close to each other repeated measurements of the same quantity are, or the ability of a measurement to be consistently reproduced. Example: a Forest Service range staff collected all the points for a project using the same GPS device and same methodology; this allows a high precision rate.

**Prescribed fire:** A fire intentionally ignited by management under an approved burn plan to meet specific objectives (synonyms: planned ignition, prescribed burn, controlled burn).

**Primitive recreation:** The reliance on personal, nonmotorized, or nonmechanized skills to travel and camp in an area, rather than reliance on facilities or outside help.

**Ranid frogs:** Ranid frogs belong to the Family Ranidae and are insectivorous usually semiaquatic web-footed amphibians with smooth moist skin and long hind legs. Bullfrogs and leopard frogs—along with many others—would be classified as ranid frogs.

**Recreation facilities:** Facilities and structures that support recreational uses such as restroom buildings, picnic tables, and campfire grills.

**Recreation opportunity spectrum (ROS):** A framework for defining the types of outdoor recreation opportunities the public might desire, and identifies that portion of the spectrum a given national forest area might be able to provide. The broad classes are:

> **Primitive:** Characterized by essentially unmodified natural environment. Interaction between users is very low and evidence of other users is minimal. Essentially free from evidence of human-induced restrictions and controls. Motorized use within the area is generally not permitted. Very high probability of experiencing solitude, closeness to nature, tranquility, self-reliance, and risk.

**Semiprimitive nonmotorized (SPNM):** Characterized by a predominantly natural or natural appearing environment. Interaction between users is low, but there is often evidence of other users. The area is managed in such a way that minimum onsite controls and restrictions may be present, but are subtle. Motorized use is generally not permitted. High probability of experiencing solitude, closeness to nature, tranquility, self-reliance, and risk.

**Semiprimitive motorized (SPM):** Characterized by a predominantly natural or natural appearing environment. Concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum onsite controls and restrictions may be present, but are subtle. Motorized use is generally permitted; roads are usually unpaved and often primitive. Moderate probability of experiencing solitude, closeness to nature, tranquility, self-reliance, and risk.

**Roaded modified (RM):** Characterized by a predominately natural or natural appearing environment. Concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum onsite controls and restrictions may be present, but are subtle. Roads are well maintained and provide easy access. Moderate probability of experiencing solitude, closeness to nature, self-reliance, and risk.

**Roaded natural (RN):** Characterized by a predominantly natural appearing environment with moderate evidence of the sights and sounds of other humans. Areas are usually road corridors where people drive to enjoy the scenery and are often on their way to a developed site (such as campgrounds, picnic area, or visitor center). Facilities harmonize with the natural environment, though interaction between users may be moderate to high. Roads are passable by low-clearance vehicles. Roaded natural areas often have rural and urban recreation opportunity settings along them, where there are opportunities to affiliate with other users in developed sites.

**Rural (R):** Characterized by a modified natural environment. The natural setting is the attraction, but there are many facilities such as buildings, roads, and signs. The sights and sounds of humans are readily evident, and the interaction between users is often moderate to high. Facilities are often provided for special activities (such as campgrounds, organization camps, and summer homes). Opportunity to observe and affiliate with other users is important, as is convenience of facilities.

**Urban (U):** Characterized by a substantially urbanized environment, although the background may have natural appearing elements. Characteristics include intensive use, clustered facilities, large numbers of people, and specialized activities. Examples include major recreation sites (such as large visitor centers) and other human needs (such as astrophysical structures and electronic sites). The opportunity to observe and affiliate with other users is very important, as is convenience of facilities.

**Reference condition:** Environmental conditions that infer ecological sustainability. When available reference conditions are represented by the characteristic range of variation (not the total range of variation), prior to European settlement and under the current climatic period. For many ecosystems, the range of variation also reflects human-caused disturbance and effects prior to settlement. It may also be necessary to refine reference conditions according to contemporary factors (such as invasive species) or projected conditions (such as climate change). Reference conditions are most useful as an inference of sustainability when they have been quantified by amount, condition, spatial distribution, and temporal variation.

**Research natural area:** A physical or biological unit in which current natural conditions are maintained insofar as possible. These conditions are ordinarily achieved by allowing natural

physical and biological processes to prevail without human intervention. Research natural areas are principally for nonmanipulative research, observation, and study. They are designated to maintain a wide spectrum of high quality representative areas that represent the major forms of variability found in forest, shrubland, grassland, alpine, and natural situations that have scientific interest and importance that, in combination, form a national network of ecological areas for research, education, and maintenance of biological diversity.

**Reserve trees:** Live trees, 6 inches diameter at breast height or larger, retained in either a dispersed or an aggregated manner after the regeneration period: seed-tree with reserves, group selection with reserves, and so forth. Trees may be retained for resource purposes other than regeneration.

**Resiliency:** The capacity of a system to absorb disturbance (whether natural or human) and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks.

**Riparian area**: Geographically delineable area with distinctive resource values and characteristics that are comprised of the aquatic and riparian ecosystems of streams and water bodies such as ponds, wetlands, springs, and seeps.

**Roundwood:** Timber used (as for poles) without being squared by sawing or hewing. Roundwood is typically smaller than sawlogs.

**Sawlogs:** a log that meets minimum regional standards of diameter, length, and defect, intended for sawing. In Region 3, a sawlog is defined as any log greater than 9 inches in diameter and 8 feet in length.

**Scale:** The aerial extent of certain plan components are described at various scales:

> **Fine scale:** Composed of individual biophysical features, such as a group of trees or shrubs, natural springs, etc. Fine scale units are 10 acres or less.
>
> **Mid-scale:** Composed of assemblages of fine scale units that have similar biophysical conditions. Mid-scale units are composed of areas that range from 100 to 1,000 acres in size.
>
> **Landscape scale:** Typically composed of variable elevations, slopes, aspects, soils, plant associations, and disturbance and ecological processes. An area at this scale is comprised of multiple mid-scale units, most often 10 or more.

**Scenery:** General appearance of a place, landscape, and its visible features (USDA Handbook Number 701 “Landscape Aesthetics. A Handbook for Scenery Management” (USDA FS 1995), slightly revised for clarity).

**Scenic class:** A system of classification describing the relative importance or value of scenery across national forest lands.

**Scenic integrity:** The degree of naturalness or a measure of the degree to which a landscape is visually perceived to be “complete.” The highest scenic integrity ratings are given to those landscapes that have little or no deviation from the landscape character valued by constituents for its aesthetic quality. Scenic alterations most typically result from human activities, but some human alterations are positive landscape character attributes (such as a historic cabin). Scenic integrity is measured in five levels:

> **Very high** (unaltered): Landscapes where the valued character is intact, with only minor deviations (such as ecological changes, hiking trails, and occasional range fences).

**High** (appears unaltered): The valued landscape character appears intact, though roads provide access to the national forest and places from which to view scenery. Activities may only repeat attributes of form, line, color, and texture found in the existing landscape character.

**Moderate** (slightly altered): The valued landscape appears slightly altered. Facilities in these areas are those valued by forest visitors (such as campgrounds and picnic areas) and privately owned recreation areas (such as summer homes, organization camps, lodges, and ski areas). Areas rated as moderate are relatively small. Noticeable deviations must remain visually subordinate to the landscape character being viewed.

**Low** (moderately altered): The valued landscape appears moderately altered. Deviations begin to dominate, but repeat form, line, color, or texture common to the landscape character. Areas rated as low are relatively small.

**Very low** (heavily altered): Human activities may dominate the original, natural landscape character but should appear as natural occurrences when viewed at background distances. Areas rated as very low are relatively small.

**Scenic integrity objectives (SIO):** Management objectives for managing scenery on National Forest System lands. SIOs indicate the degree of allowed deviation from existing landscape character.

**Sense of place:** The aesthetic, nostalgic, or spiritual effects of physical locations on humans based on personal, use-oriented or attachment-oriented relationships between individuals and those locations. The meaning, values, and feelings that people associate with physical locations because of their experiences there.

**Seral:** A plant and animal community that is transitional in stage of succession, being either short or long term. If left alone, the seral stage will pass and another plant community will replace it. Aspen represents a seral stage that eventually is replaced by conifers such as spruce.

**Significant cave:** A cave located on National Forest System lands that meets the criteria in Title 36, Code of Federal Regulations, sections 290(c) or 290(d) (36 CFR 290(c) or (d)), and has been designated in accordance with section 290.3(e).

**Snags:** Standing dead or partially dead trees often missing many or all limbs or bark. They provide essential wildlife habitat for many species and are important for forest ecosystem function.

**Soil condition rating:** A qualitative rating developed within the Southwestern Region of the Forest Service that provides an overall picture of soil condition vital in sustaining ecosystems. It is based on three soil functions: the ability of soil to resist erosion, infiltrate water, and recycle nutrients. There are four soil condition ratings:

- **Satisfactory**: soil function is being sustained and soil is functioning properly and normally.
- **Impaired**: the ability of the soil to function properly and normally has been reduced or there exists an increased vulnerability to degradation.
- **Unsatisfactory**: degradation of vital soil functions result in the inability of the soil to maintain resource values, sustain outputs, or recover from impacts.
- **Inherently unstable**: these soils are eroding faster than they are renewing themselves.

**Special use:** A permit, term permit, temporary permit, lease, or easement, or other written instrument that grants rights or privileges of occupancy and use subject to specified terms and conditions on National Forest System land.

**Stand:** A contiguous group of trees generally uniform in age class distribution, composition, condition, and structure, and growing on a site of generally uniform quality, to be a distinguishable unit, such as mixed, pure, even-aged, and uneven-aged stands. A stand is the fundamental unit of silviculture reporting and record keeping.

**Sustainability:** Meeting the needs of the present generation without compromising the ability of future generations to meet their needs. Sustainability is composed of desirable social, economic, and ecological conditions or trends interacting at varying spatial and temporal scales embodying the principles of multiple use and sustained yield.

**Targeted grazing:** Carefully controlled grazing of livestock to accomplish specific vegetation management objectives. Unlike conventional grazing management, livestock are used as a tool for improving land health by performing weed control, reducing wildland fire, and aiding in restoration projects.

**Thinning:** An intermediate treatment made to reduce stand density of trees primarily to improve growth, enhance forest health, recover potential mortality, or emphasize desired tree species. Includes crown thinning (thinning from above, high thinning), free thinning, low thinning (thinning from below), mechanical thinning (geometric thinning), and selection thinning (dominant thinning). Thinning can be used with both even- and uneven-aged management systems.

**Terrestrial:** Relating to land; living or growing on land; opposite of aquatic.

**Timber harvest:** Removal of trees for purposes other than timber production, such as ecosystem restoration, wildlife habitat improvement, or watershed protection.

**Timber production:** Growing, tending, harvesting, and regenerating crops of trees on a regulated basis to produce logs or other products for industrial or consumer use.

**Tread Lightly!®:** Outdoor ethics with a special focus on motorized and mechanized recreation (http://www.treadlightly.org).

**Unauthorized road or trail:** A road or trail that is not a forest road or trail or a temporary road or trail and that is not included in a forest transportation atlas. Sometimes referred to as “user-created” road or trail.

**Uneven-aged:** Forests that are composed of three or more distinct age classes of trees, either intermixed or in small groups.

**Well distributed:** A geographic distribution of components that is maintained throughout a given area and allows for healthy ecological function to take place.

**Wetlands**: Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

**Wild and scenic rivers** –These rivers are free flowing and have at least one outstandingly remarkable value. Eligible and suitable rivers are given a tentative classification of wild, scenic, or recreational. These rivers may be included in the National Wild and Scenic Rivers System.

- **Wild** – Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.
- **Scenic** – Those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.
- **Recreational** – Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

**Wildfire:** An unplanned ignition caused by lightning, volcanoes, unauthorized and accidental human-caused actions, and escaped prescribed fires (synonym: unplanned ignition).

**Wildland fire:** A general term describing any nonstructure fire that occurs in the vegetation and/or natural fuels. This includes both prescribed fire and wildfire.

**Wildland-urban interface (WUI):** Includes those areas of resident populations at imminent risk from wildfire, and human developments having special significance. These areas may include critical communications sites, municipal watersheds, high voltage transmission lines, church camps, scout camps, research facilities, and other structures that if destroyed by fire, would result in hardship to communities. These areas encompass not only the sites themselves, but also the continuous slopes and fuels that lead directly to the sites, regardless of the distance involved.

**Wildlife-friendly fence:** Fence of 4 wires or less with bottom wire 16 inches off the ground, top wire 12 inches above the second wire, and a fence height less than or equal to 42 inches.

**Woody biomass:** The trees and woody plants—including limbs, tops, needles, leaves, and other woody parts—grown in a forest, woodland, or grassland environment that are the byproducts of forest management used to produce bioenergy and the full range of biobased products.

**Xeroriparian:** A riparian upland transition zone where upland vegetation takes advantage of the greater residence time of additional run-on water to grow larger and denser than it grows in the uplands or in ephemeral reaches. It is considered excellent habitat for wildlife and bird nesting.

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# Appendix A. Climate Change Trends and Coronado National Forest Land Management Planning

## Overview and Background

Climate scientists agree that the Earth is undergoing a warming trend, and that human-caused elevations in atmospheric concentrations of carbon dioxide and other greenhouse gases reflect the principal cause of global temperature increases (IPCC Fourth Assessment Report, 2007). The observed concentrations of these greenhouse gases are projected to increase. Climate change is intensifying the risk of ecosystem change for terrestrial and aquatic systems, affecting ecosystem structure, function, and productivity.

This section contains a description of the climate patterns and trends in the Southwestern United States followed by a description of how current climate models and predictions may generally affect those climate patterns in the near future. Then, a short land management plan revision-oriented synthesis of climate change literature follows. This review of current climate change-related scientific literature for the Southwestern United States focuses on how climate change might be currently influencing—and may in the future impact—ecological and socioeconomic systems. The intent of the review is to examine those areas of climate change research that may have an impact on how the Coronado National Forest is managed. Specifically, this section summarizes current and future climate trends, at the regional and, if possible, the national forest level. Possible effects of climate change on ecosystems, water abundance and quality, biodiversity and wildlife species, economic conditions, and social conditions in the Southwest, and a description of limitations and uncertainties inherent in projected future climate scenarios. Finally, this document discusses possible management issues that should be considered during land management planning.

## Climate in the American Southwest and the Coronado National Forest

### What is Climate?

Climate may be defined as the "average weather," or more rigorously, as the statistical description of weather in terms of the mean and variability of relevant quantities (such as temperature, precipitation, or wind) over a period ranging from months to thousands or millions of years. The standard period is 30 years, as defined by the World Meteorological Organization. These quantities are often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the statistical description of the state or condition of the climate system.[43] In contrast, weather describes the daily conditions (individual storms) or conditions over several

[43] According to the World Meteorological Organization, the climate system is a highly complex arrangement consisting of five major components: the atmosphere, hydrosphere, cryosphere, and the land surface and biosphere, and the interactions between them. The climate system evolves in time under the influence of its own internal dynamics and because of external forces as volcanic eruptions, solar variations, and human-induced influences such as the changing composition of atmosphere and land use changes (WMO 2017).

days (such as a week of record-breaking temperatures), to those lasting less than 2 weeks.[44] Natural climate variability refers to variations due to natural internal processes (internal variability) in the climate system or natural external forcing (external variability), in the mean state and other statistics of the climate on all spatial and temporal scales beyond that of individual weather events (IPCC 2007). Climate and climate variability are determined by the amount of incoming solar radiation, the chemical composition and dynamics of the atmosphere, and the surface characteristics of the Earth. The circulation of the atmosphere and oceans influences the transfer of heat and moisture around the planet and, thus, strongly influences climate patterns and their variability in space and time. Much of the current climate change literature states that human activities such as fossil fuel burning, industrial activities, changes in land use, animal husbandry, and fertilized and irrigated agriculture lead to increases in greenhouse gases, including carbon dioxide, methane, and nitrous oxide. These increased greenhouse gases contribute to the greenhouse effect and cause the surface temperature of the Earth to increase. Global atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased markedly because of human activities since 1750, and now far exceed pre-industrial levels (IPCC 2007).

The climate of the Southwestern U.S. is often referred to as dry and hot; however, it is very complex. While low deserts of the Southwest experience heat and drying winds in the early summer, forested mountain areas and plateaus may experience cold and drifting snow during winter. Climate variability is the norm within this region, as temperature and precipitation fluctuate on time scales ranging from seasons to centuries. Monsoon thunderstorms in July and August are often accompanied by flash flooding. From fall to spring, the weather can be warm with clear skies. The Southwest also experiences periods of short- and long-term drought. Indeed, severe regional floods or droughts have affected both indigenous and modern civilizations on time scales ranging from single growing seasons to multiple years, even decades (Hughes et al. 2002).

To a large degree, a quasi-permanent subtropical high-pressure ridge over the Southwest leads to the characteristically low annual precipitation, clear skies and year-round warm weather over much of the region. This high-pressure ridge is created through Hadley circulation.[45] Where the descending branch of Hadley circulation comes down, it tends to create a zone of atmospheric high pressure that makes it difficult for clouds to form. Much of the Southwestern U.S. lies in the subtropical zone, where warm, dry air is flowing back down to Earth following its rain-inducing rise in the tropics. Descending air in the subtropics relates to an ongoing global pattern known as Hadley circulation.

In addition, the Southwest is located between the mid-latitude and subtropical atmospheric circulation regimes. This positioning, relative to shifts in these atmospheric patterns, is the main reason for the region's climatic variability. El Niño (also known as the El Niño Southern Oscillation) is an increase in sea surface temperature of the eastern equatorial Pacific Ocean with an associated shift of the active center of atmospheric convection from the western to the central

[44] The glossary of climate terms used in this report is drawn from "A Glossary of Terms" used in the "Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report" (IPCC 2007).

[45] Hadley circulation is a flow pattern that dominates the tropical atmosphere, beginning with warm, moist air rising near the equator, poleward movement 6 to 9 miles above the surface, descending motion in the subtropics, and equatorward movement near the surface. This circulation is intimately related to the trade winds, tropical rainbelts, subtropical deserts, and jet streams.

equatorial Pacific. El Niño has a well-developed teleconnection[46] with the Southwest, usually resulting in wet winters. La Niña, the opposite oceanic case of El Niño, usually results in dry winters for the Southwest. Another important oceanic influence on winter climate of the Southwest is a feature called the Pacific Decadal Oscillation, which has been defined as temporal variation in sea surface temperatures for most of the northern Pacific Ocean. The major feature that sets climate of the Southwest apart from the rest of the U.S. is the North American Monsoon, which, in the U.S., is most noticeable in Arizona and New Mexico. Up to 50 percent of the annual rainfall of Arizona and New Mexico occurs as monsoonal storms from July through September (Hughes et al. 2002).

In summary, while many factors influence climate in the Southwest during a particular year or season, the region's overall climate is defined by predictable weather patterns that occur across the years and decades to define the region's climate. The region's overall aridity relates to a global circulation pattern known as Hadley circulation, which creates a semi-permanent high-pressure zone over the Southwest. Relatively high temperatures with dynamic daily swings define this geographic region. Mountains and other differences in elevation affect local climate patterns. The North American Monsoon works to bring moisture from the tropics into the region during the summer months.

## Future Climate of the Southwest and the Coronado National Forest

Currently there appears to be broad agreement among climate modelers that the Southwestern U.S. is experiencing a drying tend that will continue well into the latter part of the 21st century (IPCC 2007; Seager et al. 2007). While the ensemble[47] scenario used by Seager et al. (2007) included two models with predictions of increased precipitation, the researchers concluded that the overall balance between precipitation and evaporation would still likely result in an overall decrease in available moisture. Regional drying and warming trends have occurred twice during the 20th century (1930s Dust Bowl, and the 1950s Southwest Drought), and were severe during what is known as the Medieval Climate Anomaly, an interval of warm, dry conditions with regional variability from A.D. 900 to 1350 (Hughes and Diaz 2008; Herweijer et al. 2007). The current drought conditions may very well become the new climatology of the American Southwest, including the Coronado National Forest, within a timeframe of years to decades.

According to recent multi-model ensemble scenarios, the warming trend observed in the last 100 years in the Southwest is projected to continue and intensify (IPCC 2007). These climate models project temperatures rising approximately 5 to 8 degrees Fahrenheit by the end of the century in the Southwest, with the greatest warming projected to occur during summer (Lenart 2008c). This trend would increase pressures on the region's already limited water supplies, as well as increase energy demand, alter fire regimes and ecosystems, create risks for human health, and affect agriculture (Sprigg 2000).

[46] Teleconnections: Atmospheric interactions between widely separated regions that have been identified through statistical correlations (in space and time). For example, the El Niño teleconnection with the Southwest U.S. involves large-scale changes in climatic conditions that are linked to increased winter rainfall.

[47] Multimodel ensembles: Researchers have found that the average of numerous available climate models--sometimes called the ensemble mean--almost always weigh in with more accuracy than any one model. This technique often uses 18 to 20 different coupled global circulation models, and combines the output from each to produce and ensemble output (CCSP 2008c).

The number of extremely hot days is also projected to rise during the 21st century. By the end of the century, parts of the Southwest, including the Coronado National Forest, are projected to face summer heat waves lasting 2 weeks longer and a fivefold increase in unusually hot days compared to recent decades (Diffenbaugh et al. 2005). In effect, the high temperatures that formerly occurred on only the hottest 5 percent of days could become the norm for a quarter of the year—100 days or more—in much of the Southwest.

Observations based on measurements from weather stations indicate that the temperature rise projected for the future is on par with the rate of increase much of the Southwest has already registered in recent decades, particularly since the mid-1970s. Since 1976, the average annual temperature increased by 2.5 degrees Fahrenheit in Arizona (Lenart 2008c). The recent temperature increase is unusual, even in the context of records dating back more than 1,200 years that were compiled from tree rings and other natural archives of temperature for the northern hemisphere (Trouet et al. 2009; Hughes and Diaz 2008; Herweijer et al. 2007; Meko et al. 2007).

Warmer winter temperatures in the Southwest have serious implications for snow cover, an important natural reservoir of water in the West. In a study conducted on two watersheds in central Arizona, Svoma (2011) found that between water years 1934 and 2007, average snowpack elevation levels have increased with a decrease in snow amounts. In his study, he directly correlated this with increasing temperatures. Shorter winters and less snowpack also affect the timing of natural cycles such as plant dormancy and blooming and peak river flows. Throughout the West, the number of days in the frost-free season, which varies by location, has been increasing more rapidly than in the East (Lenart 2007). Summer temperatures have also climbed, especially since the mid-1970s. Maximum temperatures regularly reach above 100 degrees Fahrenheit daily for weeks on end in many southwestern cities (Lenart 2007). The temperature rise alone has some predictable effects on aridity in the region. For instance, higher temperatures increase evaporation rates. Higher temperatures and a drier landscape increase wildfire hazard and put extra stress on ecosystems (Lenart 2007).

Precipitation changes remain much more difficult to predict than temperature, because precipitation is more variable and operates on a smaller scale. Predicting future precipitation is difficult in the Southwest due to added complexities such as topography, El Niño, and monsoonal timing. When comparing climate model simulations to what actually occurred, researchers found the results roughly matched 50 to 60 percent of the time for precipitation. This compares to about 95 percent of the time for temperature (Lenart 2007).

However, mean annual precipitation is projected to decline by about 10 percent by 2100 for southern Arizona, based on modeling results from an ensemble of 18 general circulation models (Lenert 2008a). Such a decrease in precipitation could have a more serious impact than the numbers suggest. The decrease of water draining from the landscape into rivers and reservoirs typically can be double or triple the proportional reductions in rainfall amounts, especially when combined with higher temperatures (Christensen and Lettenmaier 2006).

In another study, researchers using a multi-model ensemble of 19 models projected an increase in aridity for the American Southwest (Seager et al. 2007). Their study defined the Southwest as the land area stretching from east to west, from Houston to San Francisco and north to south from Denver to Monterrey, Mexico; this area includes the Coronado National Forest. Only 2 of the 19 climate models evaluated suggested a potential decrease in aridity for the southwestern quadrant of the country.

Earlier snowmelt can cause streamflows to deliver water to reservoirs and water users in greater quantities earlier in the spring season. Historically, snowmelt has occurred at the same time communities' ramp up their water consumption, which has drained reservoirs as they fill. When streamflows become elevated earlier in the year, however, reservoirs fill more quickly. Earlier future streamflows will likely increase the chance that spikes in river flows occur when the reservoirs are at full capacity, increasing the probability of flash floods (Guido 2008).

It is likely that continued warming will accentuate the temperature difference between the Southwest and the tropical Pacific Ocean, enhancing the strength of the westerly winds that carry moist air from the tropics into the Southwest during the monsoon. This scenario may increase the monsoon's intensity, or its duration, or both, in which case floods will occur with greater frequency (Guido 2008). Projections of future climate also suggest a shift in the Monsoon season, with reductions in early season precipitation and increases later in the year (Grantz et al. 2007, Seth et al. 2011).

While the region is expected to dry out on average, it is also likely to see larger, more destructive flooding (Guido 2008a). For example, the largest flood in the 75-year instrumental record of Sabino Creek in Tucson (which has headwaters in the Santa Catalina Ranger District) occurred in July 2006, and climate change was the likely contributor (Desilets and Desilets 2006). Along with storms in general, hurricanes and other tropical cyclones are projected to become more intense overall (IPCC 2007). Arizona and New Mexico typically receive 10 percent or more of their annual precipitation from storms that begin as tropical cyclones in the Pacific Ocean. In fact, some of the largest floods in the Southwest have occurred when a remnant tropical storm hit a frontal storm from the north or northwest, providing energy to intensify a remnant tropical storm (Guido 2008a).

In summary, based on multi-model ensemble climate models, by the end of the 21st century, the Southwest is likely to experience the following conditions. Temperature increases of 5 to 8 degrees Fahrenheit. An increase in the number of extremely hot days, with summer heat waves lasting 2 weeks or more, accompanied by warmer winters with a reduced snowpack, and a later monsoonal season. A 10 percent drop in mean annual precipitation in southern Arizona and an increase in extreme flood events following an overall increase in tropical storms is expected.

## Discussion

The state of knowledge needed to address climate change at the scale of the Coronado National Forest is still evolving. Because none of the current climate models adequately resolves important topographic variations (such as mountain ranges versus valleys) and climate occurrences such as El Niño and La Niña or the North American Monsoon, their results are imprecise and the subject of continuing research. However, these models do reproduce much of the underlying features of the Earth's climate, and their basic structure has been proven under countless experiments and forecasts of the weather systems from which climate is usually described. Therefore, these models remain a credible means of estimating potential future climate scenarios. Global climate models are at a much coarser scale than the scale of an individual national forest. This limits, to some degree, Coronado-specific analysis of potential effects from climate change, especially with respect to the influence of monsoons and El Niño.

Dynamical and statistical downscaling of the larger global climate models can provide additional information at scales more relevant to management decisions on the scale of the Coronado National Forest. Dynamical downscaling, also called regional climate modeling, can provide

important information about regional climate patterns such as El Niño and the North American Monsoon that are not accounted for in the larger scale global climate models. Regional climate modeling is currently underway for the Southwest and data should be available soon for the area including the Coronado National Forest (Dominguez, personal communication). Statistical downscaling is a method that uses statistical relationships between observed and modeled past climates to project future climates at finer resolutions. It is less computationally expensive than dynamical downscaling, but it does not fully account for patterns such as El Niño and the Monsoon. Statistically downscaled data is already available for the entire country, including the Coronado National Forest (Girvetz et al. 2009). These data can provide a general idea of temperature and precipitation trends, acknowledging that it does not fully account for some important regional climate patterns.

In summary, climate modeling is a developing science. General circulation models are constantly improving as are statistical and dynamical downscaling techniques. Dynamical downscaling, which incorporates jet stream activity, tropical storm and monsoon tracking, and regional elevation effects, improves localized climate projections. We know enough about major trends in temperature and precipitation patterns to begin to assess impacts on the Coronado National Forest's resources and potential management responses (USDA FS 2017).

## Southwestern Climate Change and Coronado National Forest Ecosystems

### Water and Climate Change

The prospect of future drought becoming more severe and diminished waterflows later in the season because of climate change is a significant concern, especially because the Southwest continues to lead the Nation in population growth. This signals a serious water supply challenge in the decades and centuries ahead. Water supplies are projected to become increasingly scarce, demanding tradeoffs among competing uses and potentially leading to conflict. Climate change, with both wet periods and droughts, has been a part of Southwestern climate for millennia. As of 2009, much of the Southwest remains in a drought that began about 1998 (McPhee et al. 2004). This event is the most severe western drought of the last 110 years, and has been exacerbated by record warming. The droughts of the last 110 years pale in comparison to some of the decades-long "megadroughts" that the region has experienced over the last 2,000 years (Seager et al. 2008). During the closing decades of the 1500s, for example, major droughts gripped areas of the Southwest.

Combined with the historical record of severe droughts and the current uncertainty regarding the exact causes and drivers of these past events, the Southwest must be prepared for droughts that could potentially result from multiple causes. The combined effects of natural climate variability and human-induced climate change could result in a challenging combination of water shortages for the region (Karl et al. 2009). A drier climate is very likely to decrease water supplies and increase demand for such uses as agriculture, recreation, aquatic habitat, and power, thus increasing competition for decreasing supplies (Joyce et al. 2001). In a 5-year scenario modeled after the worst drought in the historical record, water demand in Arizona could exceed supply by 67 percent, and in a 10-year scenario, demand may exceed supply by 59 percent (Lenart 2007).

Development in the Southwest has been primarily dependent upon technology to deliver water resources. The locations of most snowpack and upland reservoirs are on national forests in the Southwest (Smith et al. 2001; State of New Mexico 2005). Some studies predict water shortages

and lack of storage capabilities to meet seasonally changing river flow, and transfers of water from agriculture to urban uses, as critical climate-related impacts to water availability (Barnett et al. 2008).

While agriculture remains the greatest water user in the Southwest, there has been a decrease in the amount of water used by agriculture, as Arizona's and New Mexico's booming populations demand more water for municipal and other uses, and irrigation technologies improve; this has been an ongoing trend and could affect future agricultural uses. Without upland reservoirs and watersheds from the Coronado National Forest important to one of Arizona's largest metropolitan areas, alternative water sources, water delivery systems, and infrastructure support for agriculture would need to be developed (Lenart 2007).

The potential for flooding is also likely to increase because of earlier and more rapid melting of the snowpack in spring and more frequent intense precipitation events. Flash flooding, occurring after extended drought, may increase the number and severity of floods and accelerate rates of soil erosion. The timing and extent of storm-related precipitation will play a key role in determining the degree to which people and the environment are affected (Swetnam and Betancourt 1997; Swetnam et al. 1999; Lenart 2007).

## Climate Change and Potential Ecosystem Impacts on the Coronado National Forest

Natural ecosystems are regulated by climate, and climate is to some degree determined by natural ecosystems. Long-term or short-term climate variability may cause shifts in the structure, composition, and functioning of ecosystems, particularly in the fragile boundaries of the semiarid regions. These areas already contain plants, insects, and animals highly specialized and adapted to the landscape. A decrease in precipitation and an increase in temperature would alter their range, type, and number throughout the Southwest. Responding differently to shifts in climate, the somewhat tenuous balance among ecosystem components will also change. As phenology is altered, the overall effects among interacting species are difficult to predict, particularly given the rate of climate change and the ability of symbionts to adapt. As the health of the ecosystem is a function of water availability, temperature, carbon dioxide, and many other factors, it is difficult to determine accurately the extent, type, and magnitude of ecosystem change under future climate scenarios. Yet, should vegetation cover and moisture exchanging properties of the land change, important local and regional climate characteristics such as albedo,[48] humidity, wind, and temperature will also change with potential compounding effects to vegetation (Sprigg et al. 2000).

Current research shows that climate is much more variable than is commonly understood and that this is expressed in nested temporal and spatial scales. Millar et al. (2007) provide an elegant summation of natural climatic variables and its implications for forest managers. These are three key points from that research which should be considered in Coronado National Forest management strategies:

[48] Albedo is the reflectance of a surface. Absorbed solar radiation warms the Earth's surface, whereas, reflected radiation does not. Albedo is one component of this energy feedback. Different land covers have varied albedo. Thus, land use change can influence albedo and whether a land surface has a warming or cooling effect. For example, snow has a very high albedo and, thus, has a cooling effect (negative feedback). Melting of snow or coverage of snow with vegetation or black carbon (from air pollution) results in a higher surface albedo and has a warming effect (positive feedback) (IPCC 2007).

1. The past record clearly shows that ecological conditions change constantly in response to climate. Plant and animal species will shift even in the absence of human influence (Millar et al. 2007).
2. Wet/dry oscillations associated with ocean-atmosphere patterns have driven regional and continental scale fire patterns for centuries. These patterns provide a basis for fire forecasting tools (Westerling et al. 2006).
3. Species ranges and demographics are expected to be highly unstable as the climate shifts (Millar et al. 2007).

Climate may influence the distribution and abundance of plant and animal species through changes in resource availability, reproduction, and survivorship. The potential ecological implications of climate change trends in the Southwest indicate:

- More extreme natural ecological process events, including wildfires, intense rain, flash foods, and wind events (Swetnam et al. 1999).
- Greater vulnerability to invasive species, including insects, plants, fungi, and vertebrates (Joyce et al. 2006).
- Long-term shifts in vegetation patterns (Westerling et al. 2006; Millar et al. 2007).
- Cold-tolerant vegetation moving upslope, or disappearing in some areas; migration of some plant species to the more northern portions of their existing range (Clark 1998; Brusca et al. 2013).
- Potential decreases in overall forest productivity due to reduced precipitation (USDA FS 2005b).
- Shifts in the timing of snowmelt (already observed) in the American West, which, along with increases in summer temperatures, has serious implications for the survival of fish species and may challenge efforts to reintroduce species into their historic range (Joyce et al. 2006; Millar et al. 2007).
- Effects on phenology and changes in the date of flowering and associated pollination and food-chain disruptions (Guido 2008).

## Vegetation Changes

A warmer climate in the Southwest is expected to affect ecosystems by altering the biotic and abiotic stresses that influence and affect the vigor of ecosystems, leading to increased extent and severity of disturbances on the Coronado National Forest. Decreasing water availability and higher temperatures will accelerate the stresses experienced in forests, woodlands, grasslands, chaparral, and riparian communities, which typically involve some combination of multiyear drought, insects, and fire. As has occurred in the past, increases in fire disturbance superimposed on ecosystems, with increased stress from drought and insects, may have significant effects on growth, regeneration, long-term distribution, and abundance of forest species (Williams et al. 2010).

Many Coronado National Forest ecosystems contain water-limited vegetation today (such as desert, semidesert grassland, Madrean pine-oak and encinal woodlands, and chaparral). Vegetation productivity on the Coronado National Forest may decrease with warming temperatures, as increasingly negative water balances constrain photosynthesis, although this may be partially offset if carbon dioxide fertilization significantly increases water use efficiency in

plants (Drake et al. 1997). Many vegetation types on the Coronado National Forest are sensitive to feedbacks from environmental fluctuations and existing canopy structure that may provide trees a buffer against drought. However, severe multiyear droughts periodically cause dieback of some species. Interdecadal climate variability strongly affects interior dry ecosystems, causing considerable growth during wet periods. This growth increases the evaporative demand, setting up the ecosystem for dieback during the ensuing dry period (Swetnam and Betancourt 1997).

For example, piñon pines recently experienced a severe dieback following extreme drought in northern Arizona and northern New Mexico, both directly from moisture deficit and increased insect attacks (Breshears et al. 2005). The current dieback is historically unprecedented in its combination of fire suppression, low precipitation, and high temperatures. Increased drought stress via warmer climate is the predisposing factor, and piñon pine mortality and fuel accumulations are inciting factors (Williams et al. 2010). Ecosystem change may arise from large-scale severe fires that lead to colonization of invasive species, which further compromises the ability of piñon pines to reestablish. The science community has developed single national forest scale models that can assist forest managers in forecasting vegetation trends under different climate scenarios.

Temperature increases are a predisposing factor causing often lethal stresses on forest ecosystems of western North America, acting both directly through increasingly negative water balances, and indirectly through increased frequency, severity, and extent of disturbances—chiefly fire and insect outbreaks. Human development of the West has resulted in habitat fragmentation, creation of migration barriers such as dams, and introduction of invasive species. The combination of development, presence of invasive species, complex topography, and climate change is likely to lead to a loss of biodiversity in the region (Brusca et al. 2013). However, some species may migrate to higher altitudes in mountainous areas. It is also possible that some ecosystems, especially at the highest elevations, would virtually disappear from the region (Joyce et al. 2008).

Natural ecological processes having the greatest impact on the Coronado National Forest include insects, diseases, fires, droughts, inland storms caused by hurricanes, flash flooding, windstorms, and the introduction of nonnative species. Climate variability and changes can alter the frequency, intensity, timing, and spatial extent of these natural events. Many potential consequences of future climate change are expected to be buffered by the resilience of Coronado National Forest plant and animal communities to natural climatic variation. However, an extensive body of literature suggests that new disturbance regimes under climate change are likely to result in significant disturbances to U.S. forests, with lasting ecological and socioeconomic impacts (Joyce et al. 2001).

## Wildfire

Historically, wildfires have been recurring natural ecological processes in dry mixed-conifer forests, ponderosa pine-evergreen shrub communities, Madrean encinal and pine-oak woodlands, chaparral, and grassland ecosystems of the Coronado National Forest. An analysis of trends in wildfire and climate in the western United States from 1974 to 2004, shows that both the frequency of large wildfires and fire season length increased substantially after 1985 (Westerling et al. 2006). These changes were closely linked with advances in the timing of spring snowmelt and increases in spring and summer air temperatures. Earlier spring snowmelt probably contributed to greater wildfire frequency in at least two ways: by extending the period during which ignitions could potentially occur, and by reducing water availability to ecosystems in mid-summer before the arrival of the summer monsoons, thus enhancing drying of vegetation and

surface fuels (Westerling et al. 2006). These trends of increased fire size correspond with the increased cost of fire suppression.

In recent years, areas of western forests have been increasingly impacted by wildfires, burning homes and wildlands, and suppression costs have totaled more than $1 billion per year for Federal land management agencies. Since about the mid-1970s, the total acreage of areas burned and the severity of wildfires in pine and mixed-conifer forests have increased. Fire frequency and severity may be exacerbated if temperatures increase, precipitation decreases, and overall drought conditions become more common. In addition, continued population growth will likely cause greater human-started fires, since humans start nearly half of the fires in the Southwest. In June 2003, for example, the 84,750-acre, human-caused Aspen Fire on the Coronado National Forest (one of the largest on record) occurred during one of the warmest years on record with one of the latest monsoons.

## Insects and Pathogens

Insects and pathogens are significant natural occurring ecological processes within forest ecosystems in the U.S., costing $1.5 billion annually (Dale et al. 2001). Extensive reviews of the effects of climate change on insects and pathogens have reported many cases where climate change has affected or will affect forest insect species range and abundance, as witnessed in the Southwest. Climate also affects insect populations indirectly through effects on hosts. Drought stress, resulting from decreased precipitation and warming, reduces the ability of a tree to mount a defense against insect attack, though this stress may also cause some host species to become less palatable to some types of insects. Fire suppression and large areas of susceptible trees, a legacy from logging, may also play a role (Ryan et al. 2008).

## Invasive Species

Disturbance may reset and rejuvenate some ecosystems in some cases, and cause enduring change in others. For example, climate change may favor the spread of invasive, nonnative grasses into arid lands where the native vegetation is too sparse to carry a fire. When these areas burn, they typically convert to nonnative monocultures and the native vegetation is lost (Ryan et al. 2008). The Coronado suffers from many types of invasive species outbreaks, including plants and animals. Invasive plants can alter landscapes by overtaking native species, facilitating fire outbreaks, and altering the food supply for herbivorous animals and insects.

## Vulnerable Habitats on the Coronado National Forest

Our knowledge of possible climate change impacts on specific vegetation types remains limited (Brusca et al. 2013). However, projected and observed climate change effects are being studied at the broad-scale habitat level throughout the Southwest. The mild nature of climate gradients among lower life zones of the Southwest and protracted ecotonal bands, make woodland plant communities particularly vulnerable (Allen and Breshears 1998; Adams et al. 2009). In addition, systems that rely on water are also vulnerable due to projected changes in precipitation and water inputs. Many of the region’s plant and animal species are associated with these key habitats, and they are, therefore, important when considering the potential impacts of climate change on ecosystems managed by the national forests in the Southwest.

## Riparian Habitats

Riparian habitats are very important for wildlife on the Coronado National Forest, as well as an unknown number of invertebrate and plant species that inhabit or use riparian areas at some time during their life. The majority of models project declines in water inputs due to reduced precipitation, and subsequent reductions in water in riparian zones. Water losses are also likely to increase due to elevated evapotranspiration rates at higher temperatures and greater runoff losses associated with increased frequencies of high intensity convectional storms. Urban expansion will also increase human demand for water and further reduce water availability for wildland ecosystems. Decreased water availability would affect riverine and riparian ecosystem function, due to modifications in geomorphological processes and an overall reduction in the availability of moisture to plant communities. Although these areas comprise less than 1 percent of Coronado National Forest lands, they provide critical habitat for vertebrates, invertebrates, migratory birds, and other riparian-dependent species. Reduced water inputs will cause riparian ecosystems to contract in size. Furthermore, lowered water availability would stress riparian plants and increase the ecosystem susceptibility to invasion by nonnative plants, such as salt cedar and Russian olive, which, in turn, could disrupt the natural wildlife community (Archer and Predick 2008).

## Wetlands

Climate change is likely to affect native plant and animal species by altering key habitats such as wetland ecosystems (Karl et al. 2009). Wetlands create unique habitats and microclimates that support diverse wildlife and plant communities. Wetland habitats contain a distinctive native plant community typical of saturated soils. Plants may include sedges, rushes, mosses, monkey flowers, lilies, and algae. Animal species occurring in the wetlands include northern raccoon, Arizona treefrog, Northern Mexican gartersnake, and Huachuca springsnail among other specialized aquatic invertebrates.

## Sky Islands

Mountainous “sky islands” of the Coronado National Forest are made up of forested ranges separated by expanses of desert and grassland plains, are among the most diverse ecosystems in the world because of their great topographic complexity and unique location at the meeting point of several major desert and forest biological provinces. “Sky islands” refers to a particular area versus the other habitats that essentially refer to life zones of the Southwest (including those of sky islands). The patterns described here for sky islands are applicable to many areas of the Southwest. The sky islands are particularly vulnerable to fragmentation, which may exacerbate the effects of climate change. These mountain ranges are isolated from each other by intervening valleys of grassland or desert. The valleys of these basins act as barriers to the movement of certain woodland and forest species. Species, such as mountain lions and black bears, depend on movement corridors between mountain islands to maintain genetic diversity and population size. The region is a blend of tropical and temperate, harboring well over half the bird species of North America, 29 bat species, over 3,000 species of plants, and 104 species of mammals, a diversity exceeding anywhere else in the U.S. Climate change poses a unique threat to sky islands. Temperature increases of as little as a few degrees could push sky island habitats to higher elevations, reducing their area and potentially causing local extinction of endemic taxa and divergent populations harboring unique genetic and phenotypic diversity (Kupfer et al. 2004; Brusca et al. 2013). Sky islands in the Southwest and Mexico are already being affected by climate change, with increases in drought, fire, and outbreaks of invasive insects (Williams et al. 2010). Although these resilient systems have endured large-scale shifts in climate during and

since the last ice age, the pace of human-induced climate change may represent an insurmountable challenge for sky islands, with potentially devastating consequences to their biodiversity and evolutionary potential (Sky Island 2007). A recent assessment of climate change in the Southwest found that many sky island forest systems are among the most vulnerable to climate change because of the combination of most rapid recent temperature increases and a high number of species of conservation concern (Robles and Enquist 2010).

## Aquatic Systems

There are already observed shifts in the timing of snowmelt in the American West, which, along with increases in summer air temperatures, have serious implications for the survival of fish species and may render some efforts useless to reintroduce species into their historic range (Millar et al. 2007). For cool and cold-water species, a nearly 50 percent reduction in thermal habitat is projected with scenarios of increased water temperatures (Eaton and Scheller 1996). Predicted impacts to aquatic ecosystems include altered seasonal high flow events, increases in drought severity during summer flows, and increasing temperatures in small streams and tributaries that further limit habitat during seasonal flows (Williams and Meka-Carter 2009).

The fundamental physiological components of growth and metabolism are strongly affected by temperature (Schmidt-Nielsen 1997). For fishes, this implies that populations highly adapted to local climates that experience increases in temperatures in excess of their optimum values for growth will reduce consumption rates and increase metabolic rates; this results in decreased growth. Fish increase feeding rates to compensate for poor growing conditions caused by increased temperature, which can lead to greater visibility and encounter rates with predators. Trout in whole lake experiments had lower survival at temperatures above optimum, and those populations with the highest temperatures and lowest food abundance experienced the lowest survival. The prediction is for an increasing frequency of poor or failed year-classes where fish cannot escape the warmer conditions. Research, so far, reflects a basic understanding of the impacts of climate warming on individuals, but not on the outcomes at the population levels (Biro et al. 2007). Current stresses on native aquatic species, including heat tolerant nonnatives add to the complexity of managing and adapting to climate change.

## Plant and Animal Species

Research suggests large changes in the structure and species composition of plant communities due to the warming air temperatures and altered hydrological cycles. Many of the region’s plant, animal, and insect species depend on precise phenological events based on climatic conditions for migration, flowering, and timing for foraging and reproductive activities. Climate thus influences their distribution and abundance through changes in resource availability, fecundity, and survivorship. It is currently unknown how many species will successfully adapt to changing conditions. The ability of plant and animal species to migrate under climate change is strongly influenced by their dispersal abilities and by disturbances to the landscape. Land use changes and habitat alterations around the Coronado National Forest will add to the challenge of plant and animal species adapting to climate change. Within an ecological context, wildlife and plant responses to climate change in the region are highly dependent on interaction between weather, land use, land cover, hydrology, fire, and stresses from invasive, nonnative species.

## Distribution

Many studies of species support the predictions of systematic shifts in distribution related to climate change, often via species-specific physiological thresholds of temperature and precipitation tolerance (Brusca et al. 2013). Temperature is likely to be the main driver for different species, including possible shifts in a coordinated and systematic manner throughout broad regions (Rosenzweig et al. 2007). Species at the upper elevations are at greater risk of being extirpated since they may not be able to adapt to habitat changes. Such organisms face increased risk of extinction (Hoegh-Guldberg et al. 2008). In many instances, the impacts of range shifts will go far beyond the mere addition or subtraction of a species to or from a system. Some range shifts will have cascading effects on community structure and the functioning of ecosystems (Lawler et al. 2009).

## Habitat Quality

Climate change may cause a host of physical consequences to the ecosystems, which may affect the quality of plant and animal habitats. This may occur through a decrease in available water, changes in vegetation type through decline in vigor, severe drought or fire, or through changes in hydrology. Large areas of forest that were once suitable habitat for some species of wildlife may no longer be suitable, potentially leading to significant changes in species due to loss of needed habitat components (Karl et al. 2009).

## Behavior and Biology

The timing of seasonal activities of plants and animals is perhaps the simplest process in which to track changes in the response of species to climate change. Observed phenological events include leaf unfolding, flowering, fruit ripening, leaf coloring, leaf fall of plants, bird migration, chorusing of amphibians, and appearance/emergence of insects (Rosenzweig et al. 2007).

Large herbivores, such as pronghorn, inhabiting highly seasonal temperate environments are subject to drastic daily and seasonal changes in environmental quality. During summer, they must acquire sufficient resources for growth and reproduction, and to survive the following winter. Foraging behavior in summer is, thus, vitally important. Higher temperatures may reduce the daily activities of large herbivores. This may affect foraging, growth, reproduction, and overall health of animals. They may experience hardship during the winter and may not reproduce as successfully (Aublet et al. 2009). In reptiles and amphibians, increased temperatures and changing precipitation could negatively affect reproduction, for many of the same reasons as with fish (Hulin et al. 2009). Impacts are also possible to the migration and dispersal routes of many species, including migratory songbirds, which are already of concern due to declines in abundance (Sillett et al. 2000).

## Fragmentation and Isolation

The effects of fragmentation likely range across the full spectrum of biological diversity, from altering behavior of individuals, their genetics, and the demographic characteristics of populations, which can fundamentally change the structure and function of ecological communities (Lomolino and Perault 2007). Climate change may contribute to further fragmentation of habitat and to creating barriers to migration. Fragmentation and barriers are likely to impede elevational or northward migration of many species, resulting in decreases in their total range. Habitat loss and fragmentation may also influence shifts in a species

distribution. Empirical evidence shows that the natural reaction of species to climate change is to redistribute to more favorable habitats. However, this redistribution may be hampered by fragmentation by simply isolating suitable areas for colonization and preventing species movements, which may contribute to their extinction (Rosenzweig et al. 2007).

## Southwestern Climate Change and Socioeconomic Effects

A review of the literature found few substantive studies of the possible social and economic effects that climate change might cause or exacerbate in the Southwest. Most climate-related socioeconomic studies are either heavily theoretical, or too broad and general to apply specifically to the region. Over thousands of years, societies in the Southwest have faced climate change repeatedly; some successfully, some not so successfully (Dean 2000). It is often difficult to "draw a conceptual line between climate change and other kinds of environmental transformations: both affect human societies by changing the availability of resources" (Tainter 2000). How societies adapt to climate change is fundamentally dependent on how they approach problem solving (Tainter 2000). However, some of the more general social and economic projections can help to inform us about climate change effects on the region.

Population distribution, economic activity, quality of life, and many other human values are influenced by changes in natural environments. Populations in Arizona and New Mexico are growing at unprecedented rates. The combination of population growth and climate change will likely exacerbate climatic effects, putting even greater pressure on water, forest, and other resources. Additionally, pressures put upon agriculture and other climate-sensitive occupations in neighboring Mexico may increase an already large migration of people into the Southwestern U.S., making disease monitoring increasingly difficult (Sprigg et al. 2000; Smith et al. 2001). While this is the current demographic trend in the Southwest, if conditions become too hot and dry, there may very well be a decrease in the number of people moving to the region.

Recent research in the Southwest shows that up to 60 percent of the climate-related trends of river flow, winter air temperature, and snowpack between 1950 and 1999 are human induced. The study predicts water shortages, lack of storage capabilities to meet seasonally changing river flow, transfers of water from agriculture to urban uses, and other critical impacts (Barnett et al. 2008). The region's economy will likely continue to grow in the future. Increases in service-oriented sectors as well as the expanding high-tech industry may bring more jobs and employment opportunities for the growing population. Significant changes due to population pressures include decreased forest cover; increased construction; additional Federal and State parks, wilderness areas, and wildlife refuges; more land used for national defense and industry; expanded urban areas; and decreased pasture and rangelands (Joyce and Birdsey 2000).

Forests significantly enhance the environment in which people live, work, and play. Population levels, economic growth, and personal preferences influence the value that is placed on forests and, consequently, the resources demanded from forests. Changes caused by human use of forests could exceed impacts from climate change. According to Forest Service National Visitor Use Monitoring data (USDA FS 2015b), the majority of recreation visitors on the Coronado National Forest come from the Tucson metropolitan area. The Coronado received nearly 2.5 million visits in 2007, with the majority visits from local Pima County residents. Many Arizonans consider access to public lands a major contributor to the quality of life. Many southwestern forests as well as the Coronado National Forest are experiencing very high recreational use while urban expansion is decreasing the amount of available open space. Climate change could have long-

term impacts on many of the amenities, goods, and services from national forests. There could be impacts to recreational opportunities, productivity of locally harvested plants (such as several species of agave and cholla, prickly pear, mesquites, desert hackberry, grasses and sotols), local economics (through land use shifts from forest to other uses), forest real estate values, tree cover and composition in urban areas, and associated benefits and costs. Private agricultural, urban, and suburban areas are expanding and affecting Forest Service management. This expansion of human influences into the rural landscape alters natural ecological process patterns associated with fire, flooding, landslides, and native and introduced species. These land use changes are very likely to interact with and potentially exacerbate stresses on forests associated with climate change (Joyce and Birdsey 2000).

## Livestock Grazing

Livestock grazing is one of the management activities occurring on the Coronado National Forest. Ranching is a social, cultural, and agricultural activity throughout the rural Southwest. It is a major land use in both Arizona and New Mexico, and its success depends on the natural vegetation accessible to grazing animals. The Coronado National Forest provides forage for livestock grazing, but it also provides crucial habitat for wildlife. Lands grazed on the Coronado National Forest are not irrigated, and any variability in precipitation and temperature directly affects forage plant production and wildlife habitat. Changes in climate may affect the vigor and productivity of forage plants and, thus, the overall conditions of both wildlife habitat and ecological conditions. It is possible that higher temperatures and decreased precipitation described for the next century will also decrease forage production and shorten the growing and grazing season, while flash floods and increased risk of animal disease can adversely affect the livestock industry (Joyce et al. 2001) dependent upon the Coronado National Forest's forage resources. During drought years when forage is less available, ranchers may have to purchase supplementary feed or sell their livestock at reduced prices (Eakin and Conley 2002).

Coupled with poor forage conditions, there may be a general scarcity of water for livestock. For a pasture to be available for grazing, it not only has to have sufficient nutritious vegetation, but adequate water availability as well. Some allotments and pastures rely on wells and developed springs, but many often use dirt tanks to capture snowmelt and monsoon rainfall, and use this water for livestock. During the recent droughts, many dirt tanks in southern Arizona dried up, making many pastures unusable for cattle even though forage may have been available (Eakin and Conley 2002). Ranching is in a vulnerable position, especially when viewed against a backdrop of changing climate, economic structure, urban expansion, increasing population, fluctuating market conditions, resource availability (Sprigg et al. 2000), and changing public policies.

## Recreational Value

Climate change affects national forest ecosystems and the relationships people have with those places. Population distribution, economic activity, quality of life, and many other human values are influenced by changes in natural environments. The Coronado National Forest provides many recreational opportunities including hiking, camping, hunting, bird watching, skiing, and water-related activities such as fishing and boating. These activities provide income and employment in every forested region of the U.S. Outdoor recreation opportunities are likely to change, with resulting changes in public expectations and seasonality of use. Higher temperatures are very likely to result in a longer season for summer activities such as backpacking, but a shorter season for winter activities such as skiing. Areas at low elevations and in more southern districts are very

likely to be at particular risk from a shortening of the snow season and rising snowlines (Joyce et al. 2001; Svoma 2010). In areas of marginal annual snowpack, this reduction may result in the closure of some ski areas.

Urban and suburban expansion into undeveloped lands is likely to shift in response to climate change. Population shifts may cause new resource-related human conflicts, and create unforeseen impacts on already stressed urbanized ecosystems. As temperatures increase in lowland urban areas, recreation is likely to increase on the Coronado National Forest, where cooler temperatures will attract people to higher elevations as a refuge from increasingly hot summers (Irland et al. 2001).

## Health

Future climate scenarios will undoubtedly amplify current climatically driven human health concerns, with potential increased risk of dengue fever, encephalitis, and other diseases associated with warmer climes, and the northern movement of disease vectors, such as malaria-carrying mosquitoes. Diseases such as valley fever and Hantavirus pulmonary syndrome are endemic in the Southwest. The incidence of Hantavirus has been linked to seasonal and interannual patterns of rainfall (Eisen et al. 2007). Research strongly suggests that valley fever is connected to the sequence and pattern of precipitation and wind. Future climate scenarios will undoubtedly amplify current climatically driven human health concerns. Projected temperature increases are anticipated to create greater numbers of heat-induced illnesses, reduced air quality, and increased cases of respiratory illness due to the presence and persistence of dust, allergens, and ozone (Wise 2009). Conversely, in many temperate areas, which include the Southwest, there is clear seasonal variation in mortality; death rates during the winter season are 10 to 25 percent higher than in the summer. Several studies cited by the Intergovernmental Panel on Climate Change indicate that decreases in winter mortality may be greater than increases in summer mortality under climate change (McMichael et al. 2001).The geographical range of disease-bearing vectors such as the mosquito would expand under the model scenarios for the 21st century (Liverman and Merideth 2002). Pressures put upon agriculture and other climate sensitive occupations in neighboring Mexico may increase an already large migration of people into the Southwestern United States, making disease monitoring increasingly difficult (Sprigg et al. 2000). This is of interest to the Coronado National Forest and surrounding communities because the majority of forest users are from Pima County. Increased visitor use could be the vector necessary to spread any number of these health issues.

## Energy

Higher air temperatures may increase the overall demand for energy within the region’s urban areas; and this increasing energy demand could affect the Southwest’s current socioeconomic environment (Sprigg et al. 2000; Smith et al. 2001). Electricity supports human activity and offers the possibility of economic growth. For much of the region, water delivery systems rely on electricity for pumping groundwater and for directing water throughout the system. Urban and agricultural uses of energy driven water resources are essential in the region’s current socioeconomic environment. During the warmest summer months, energy demands increase with the use of energy intensive air-cooling systems. Given population projections for the region, a greater number of electricity generating plants will be needed to handle the demands that follow. Climate warming contributes to increased energy demands and evaporative loss from reservoirs. All reasonable scenarios of future climate variability must be considered when anticipating the

costly measures necessary to provide dependable, safe, and reasonable supplies of energy (Sprigg et al. 2000). Increasing energy demand and the ensuing demand for alternative energy will likely impact the Coronado National Forest through growing needs for new energy corridors, requests for wind and solar energy sites, and other special use related requirements, as well as the current and ongoing demand for biomass supplies to existing electrical cogeneration plants.

## Key Climate Change Effects on the Coronado National Forest's Desired Conditions

Based on current climate model projections and research, the climate change factors that appear most likely to affect the Southwestern Region and Coronado National Forest and affect desired conditions in the revised land management plan are ecological, weather-related disturbances, and socioeconomic demands, as described:

- Projected increase in frequency of extreme weather events (intense storms).
- Projected increase in wildfire risks.
- Projected increase in outbreaks of insects, diseases beyond endemic levels, and nonnative invasive species.
- Projected increase in demand for deceasing upland water supplies.
- Projected increase in national forest socioeconomic uses and demands.

These natural ecological processes, human-caused disturbance factors, and the potential impacts on desired conditions for the national forests in the Southwestern Region and the Coronado National Forest are described below.

### Increased Extreme Weather Events

Climate change likely will increase flash floods, making the region's growing population more susceptible to loss of life and property. While the Southwest and Coronado National Forest are expected to become warmer and drier, they are also likely to experience more flooding. This relates in part to the fact that warm air holds more moisture than cooler air. The frequency of floods is also influenced by the rate of snowmelt in the winter and spring, the character of the summer monsoon, and the incidence of tropical hurricanes and storms in the autumn.

Hurricanes and other tropical cyclones are projected to become more intense in the future. Since Arizona and New Mexico typically receive 10 percent or more of their annual precipitation from tropical storms, it is likely that this change will also increase flooding. In Arizona and New Mexico, floods killed 57 people between 1995 and 2006, while hundreds of others have needed swift water rescues. The economic price tag is also high, costing Arizona, New Mexico, Colorado, and Utah approximately $5 billion between 1972 and 2006. A potential increase in extreme storms, floods, heat waves, and droughts may present challenges for achieving desired conditions.

Impacts from extreme weather events could include changes in the composition and diversity of desired ecosystems, destruction of habitat, timber loss, increasing damage to the Coronado's infrastructure such as trails, facilities, and roads, and loss of recreation opportunities. Natural ecological process events that exceed the historic range of natural variation can change the makeup, structure, and function of vegetation types and watersheds and could affect a number of desired conditions. Heavy rains and higher flood levels can affect maintenance and structural

integrity of forest infrastructure and slow progress toward improvements. Flooding is a natural and beneficial process in many aquatic systems. However, damage to aquatic systems from flash flood caused erosion, downed trees, and inundation from flooding can change streamside habitats, affect aquatic life, and impact proper functioning of stream channels. These processes could create challenges in the ability of a national forest to achieve plan objectives for aquatic habitat restoration. Overall, increasing weather-related disturbances can divert limited Coronado National Forest staff and funding to recovery efforts for extended periods and delay progress toward desired conditions, or it may require reevaluation of desired conditions, to allow for a more dynamic resilience.

### Wildfire

Wildfire is another climate-related impact to ecosystems in the Southwest. Historically, wildfires have played an important role in the vitality of fire-adapted ecosystems. Past management and fire suppression practices have changed the dynamics of fire on the landscape within the Coronado National Forest, resulting in greater fuel loads and risk of wildfire. Fire suppression activities in the West, including those conducted by Federal land management agencies, routinely exceed expenditures of 1 billion dollars per year. Since about the mid-1970s, the total acreage area burned and the severity of wildfires in pine and mixed-conifer forests have increased on the Coronado National Forest. Fire frequency and severity will likely increase as temperatures rise and precipitation decreases. Population growth in the Southwest may also lead to greater numbers of human-started wildfires. In summary, an increase in wildfires will lead to an increase in expenditures, risks to life and property, and will likely divert resources and staff time to fire-related efforts on the Coronado National Forest. This may lead to a decrease in staff and resources for other efforts and delay or halt progress toward achieving desired conditions in some areas.

### Outbreaks of Insects, Diseases, and Nonnative Invasive Species

Disturbances associated with climate change can have secondary impacts indirectly caused by wildfire and climate-related extremes. Increased variation in temperature and moisture can cause stress and increase the susceptibility of forest ecosystems to invasions by insects, diseases, and nonnative species. New environmental conditions can lead to a different mix of species and tend to be favorable to plants and animals that can adapt their biological functions or are aggressive in colonizing new territories (Whitlock 2008). However, changes in adaptability may be too slow given the predicted rate of change. Species that are already broadly adapted may become more prevalent and species with narrow adaptability may become less prevalent. Disturbance factors that create more vulnerability in native ecosystems or require extensive controls to maintain the status quo are likely to affect the Coronado National Forest's desired conditions for healthy and diverse forests.

### Diminishing Water Resources

As stated previously, locations of most snowpack and upland reservoirs are on national forests in the Southwest. In many western mountain ranges, less precipitation is falling as snow and spring melting is occurring earlier in the year. The Colorado, Rio Grande, and several other southwestern rivers have streamflows that appear to be peaking earlier in the year, suggesting that the spring temperatures in these regions are warmer than in the past, causing snow to melt earlier. Water supplies are projected to become increasingly scarce, calling for tradeoffs among competing uses, potentially leading to conflict. Without upland reservoirs and watersheds, many

managed by the U.S. Forest Service, elaborate water delivery systems, and other infrastructure support, agriculture, urbanization, and other development could be severely constrained. In the Southwest, intense debate will likely continue over resource allocation and conservation of available supplies. Increasing conflicts over water could lead to diminished supplies on the Coronado National Forest needed to achieve desired conditions related to vegetation, aquatic species, and recreation, among others.

### Climate-Related Socioeconomic Demand

Populations in Arizona and New Mexico are growing at an unprecedented rate. As of the latest American Communities Survey (2009), Arizona's population was 6,595,778. The total increase for Arizona between 1980 and 2009 has been over 123 percent. New Mexico's current population of 2,009,671 represents a percent change of over 47 percent between 1980 and 2009. Currently, over 5 million people live within a 5-hour drive of the Coronado National Forest. The combination of population growth and climate change will likely exacerbate climatic effects, such as increasing visitor use, putting even greater pressure or demand on water, recreational opportunities, and other resources on the Coronado National Forest. Climate change could have long-term impacts on many of the amenities, goods, and services from the Coronado National Forest. These include productivity of locally harvested plants such as berries or mushrooms, wildlife, local economics through land use shifts from forest to other uses, forest real estate values, and tree cover and composition in urban areas, and associated benefits and costs. Climate, combined with increasing regional population also will likely increase demand for water-related recreation opportunities on the Coronado National Forest, as residents of urban areas seek relief from rising temperatures. The number of human-caused fires and wildlife-human conflicts will likely increase as well. Greater recreation demands and use on the Coronado National Forest may also put additional strains on roads and trails, create greater needs for more facilities such as parking spaces and restrooms, and increase the use of dispersed campsites. Because of these stressors, it may be difficult for Coronado National Forest managers to maintain places in their natural character and remote, undeveloped sites may be at risk for being lost.

## Potential Climate Change Strategies for the Coronado National Forest

The five potential management strategies described below relate to the five projected, key climate change factors that are most likely to be a potential concern for the Southwestern Region and Coronado National Forest in moving toward the desired conditions in the plan. These are extreme weather events, wildfire and human-caused risks, insects, diseases, and invasive species, water use and demand, and increase in socioeconomic demands. These management strategies focus on ways to incorporate changes from disturbances into managed forests and enhance ecosystem resilience.

When developing strategies for managing future changes, the range of possible approaches could be quite broad. The management strategies listed below are focused on recommendations from recent research studies, including the U.S. Climate Change Science Program, SAP 4.4 (CCSP 2008b), which are appropriate for the Southwestern Region and Coronado National Forest, and balance effectiveness, feasibility, and available resources. Although some strategies contain new ideas, most of these management options include practices that are already in effect, can serve multiple needs, and may just need to be adjusted or expanded to respond to climate changes during the next 5 to 15 years. Using an adaptive management approach will allow national forest

managers to adopt and adjust strategies as new information is available, conditions change, and staff and resources are available.

The key climate change factors are addressed directly or indirectly through the Coronado National Forest's desired conditions, objectives, and management approaches. They include:

- Enhancing adaptation for ecosystems most vulnerable to climate change, including ecosystems where resilience is already compromised.
- Enhancing adaptation by anticipating and planning for disturbances from intense storms.
- Using a suite of adaptation options to manage ecosystems in the face of uncertainty.
- Increasing water conservation and planning for reductions in upland water supplies.
- Anticipating increased forest recreation use.
- Monitoring climate change influences and the effectiveness of adaptation approaches.

## Enhancing Adaptation for Ecosystems Most Vulnerable to Climate Change, including Ecosystems where Resilience is already Compromised

The Climate Change Vulnerability Assessment for the Coronado National Forest (USDA FS 2017) is an ecosystem-based evaluation of the potential vulnerability of major upland ecological response units. An ecological response unit is a mapping unit that combines finer scale vegetation classes that share similar ecosystem processes and successional dynamics, as well as potential vegetation under historic disturbance regimes. The Climate Change Vulnerability Assessment also evaluated the resistance and resilience of ecosystems. Resistance is the ability of an ecosystem to endure disturbance and maintain structure, composition, and function that are characteristic of the system. Resilience is the ability of an ecosystem, following disturbance, to regain the structure, composition, and function that are characteristic of the system on a time span consistent with its successional patterns. Resilience may be reduced as departure from historic fire regime increases, especially for some ecosystems such as Madrean Pine-Oak Woodlands, Madrean Encinal Woodlands, Ponderosa Pine-Evergreen Oak, Mixed Conifer-Frequent Fire, Ponderosa Pine Forest, and Pinyon-Juniper Grasslands.

The Climate Change Vulnerability Assessment identifies four vulnerability categories: low, moderate, high, and very high. Considering all ecosystems combined, the Coronado National Forest has 3 percent low, 27 percent moderate, 38 percent high, and 33 percent very high vulnerability categories. For this assessment, the desert ecological response units were not included due to data gaps, but there is some indication that desert systems of the Southwest are already expressing vulnerability, especially those with vegetation composition changes brought about by invasive species that have altered historic fire regimes. The information contained in the Climate Change Vulnerability Assessment can assist in identifying needs for vegetation treatments that can enhance adaptation to climate change. The ecological response units that are characterized as very high vulnerability for the Coronado National Forest are Sandy Plains Grasslands (100 percent very high); Juniper Grassland (68 percent very high); Mixed Conifer-Frequent Fire (52 percent very high); and Madrean Encinal Woodland (48 percent very high). Strategies to improve ecosystem resiliency in frequent-fire forests that are highly vulnerable to climate change effects have been identified through ongoing research (Reynolds et al. 2013). It is believed that restoration of vegetation composition and structure on a site-specific basis will position these vulnerable vegetation types to better resist and adapt to future climate and disturbances.

## Enhancing Adaptation by Anticipating and Planning for Disturbances from Intense Storms

Although occurrences of storms and other disturbances cannot be precisely predicted and are often beneficial types of disturbance, anticipatory planning may predict impacts and have adaptive guidelines in place to protect sensitive areas. Areas such as riparian zones, endangered species habitats, and special areas may require different approaches for reducing disturbances or recovering from damaging events. Management responses from previous events can provide guidance for similar situations and take advantage of prior learning experiences. Planning prior to disruptions can take advantage of disturbances when they eventually occur to convert vegetation to more resilient and desirable ecosystems, and reduce assessment and response time while ensuring that sensitive resources requiring special responses are protected.

With the projected increase in extreme weather events, management practices for reducing soil erosion may be even more critical in the future. For example, standard soil erosion best management practices such as buffers filter strips, broad-based dips, and piling slash downslope of skid trails and along streams, can help mitigate increased erosion conditions. Roads and trails close to streams may be closed, removed, revegetated, or relocated away from stream channels to reducing impacts to aquatic ecosystems and water quality. In another example, appropriately sized culverts at stream crossings should consider projections for future runoff in a changing climate as well as historic conditions. New recreation sites such as campgrounds and other facilities should be located well away from potential flash flood areas.

## Using a Suite of Adaptation Options to Manage Ecosystems in the Face of Uncertainty

Managing ecosystems under uncertainty necessitates flexible and adaptive approaches that are reversible, are implemented in incremental steps that allow for new information and learning, and can be modified with changing circumstances (Millar et al. 2007). Coronado National Forest ecosystems have evolved under a long and complex history of climate variability and change. Taking into consideration the number of megadroughts, and other climate-related variation, through time, these plant and animal communities have a built-in resilience. Restoring and maintaining resilience in forest, woodland, chaparral, grassland, desert, and riparian ecosystems are part of the basic elements of forestwide desired conditions, objectives, and management approaches. Risks of increased wildfire, outbreaks of insects and disease, invasive species, and loss of habitat represent ongoing, broad-scale management challenges to management of the Coronado National Forest. These issues are nothing new. However, climate change has the potential to increase the impacts of these ecosystem risks.

Millar et al. (2007) break down potential ecosystem adaptation options into the following three categories:

- Creating resistance to change: preventing disturbance through the creation of firebreaks and the removal of invasive species.
- Promoting resilience to change: managing ecosystems so they may return to their previous state following a disturbance.
- Enabling ecosystems to respond to change: includes increasing connectivity to allow migration of species to new areas, assisting migration of species and genotypes, and allowing new ecosystems to establish instead of restoring to historical conditions.

On-the-ground tactical approaches can often blur the lines between these adaptation options, especially between resistance and resilience strategies. Below are a few current management tools employed by the Coronado National Forest that will help achieve its desired conditions in the face of increased disturbances and changing climate.

Prescribed (planned ignition) fires are a current management tool that can serve multiple purposes, from sustaining desired conditions for fire-adapted ecosystems and sustaining habitat for threatened and endangered species to reducing fuel loads. Prescribed burning is also a management strategy that will be important for maintaining desired habitats in a changing climate with more natural disturbances. With projections for more frequent storms and other extreme weather events, plus the potential for increased stresses from insects and diseases in a warmer, drier climate, planned and unplanned ignition burning will continue to be an important management strategy for the future.

Although current programs and guidance are already in place to limit the introduction of nonnative species, treat invasive species, and manage insects and diseases, these efforts are likely to become more critical to maintaining desired conditions for healthy plant and animal communities under a changing climate. Due to the relationship of land ownership patterns, success in reducing forest pests requires going beyond Coronado National Forest's boundaries, and continued collaboration with partners will be needed. In addition, management practices (such as thinning for age class diversity and structure, and reclaiming and restoring native grasslands) that sustain healthy plant and animal communities and provide adequate nutrients, soil productivity, and hydrologic function, promote resilience and reduce opportunities for disturbance and damage.

Landscape connectivity is the degree to which the landscape facilitates or impedes movement of a species among habitats required for its persistence with few physical or biotic impediments to migration (Taylor et al. 1993; Millar et al. 2007). Connectivity has two components: structural and biological connectivity. Structural connectivity, the spatial structure of a landscape, can be described from map elements. Biological connectivity is the response of individuals to the scale of landscape features (Brooks 2003). Large, interconnected blocks of habitat support a wide array of species, and allow for genetic and behavioral interactions that are lacking with the creation of small patches (Robinson et al. 1995). Promoting connectivity in landscapes with flexible management goals that can be modified as conditions change may assist species to respond naturally to changing climates. Desired goals include reducing fragmentation and planning at large landscape scales to maximize habitat connectivity (Millar et al. 2007). The Coronado National Forest's desired conditions, objectives, and management approaches address the importance and need for connectivity for both terrestrial and aquatic habitats.

Changes in disturbance regimes and underlying climate may result in conditions where it is no longer possible to maintain existing genotypes, species, or even ecosystems in some places. When this occurs, one option is to intentionally introduce species or genotypes (or mixtures of species or genotypes) into new areas that may be better suited to the current conditions. For example, spruce aphid has been devastating to Engelmann spruce in the Coronado's spruce-fir forests and may possibly become more problematic under future climate change. Options that may facilitate transitions to more adapted ecosystems may include introducing aphid-resistant genotypes or possibly finding a substitute species that serves in a similar functional role to Engelmann spruce in some areas. The Coronado National Forest's desired conditions, objectives, and management approaches are flexible enough to allow consideration of these tactics should they become the most viable option.

These tactics are just a few of many possible management approaches that may be employed to allow ecosystems on the Coronado National Forest to adapt to a changing climate. As new challenges arise, the Coronado will have to be flexible and creative in its approaches to maintain healthy, functioning ecosystems.

## Increasing Water Conservation and Planning for Reductions in Upland Water Supplies

As mentioned earlier, aquatic and riparian ecosystems may be negatively impacted by increasing temperatures and reduced precipitation. Too much water arriving at once, in the form of severe storm events, also has the capacity to affect these water-dependent ecosystems. Water amount, availability, distribution, and allocation for a variety of ecological, wildlife, and aquatic species, as well as for human uses, needs to be considered in planning.

Municipal water supplies of Arizona are dependent on these upland sources. In many western mountain ranges, including those on the Coronado National Forest, less precipitation is falling as snow, and spring melting is occurring earlier in the year. These water sources and associated water rights have always been important and contentious areas of concern for public land managers in the Southwest and Coronado National Forest. With climate change, planning for water quantity and quality may become even more important. To address such concerns, planners may wish to consider some of the following measures:

- Determining the water rights status of water resources for range, wildlife, public drinking systems, firefighting, recreational uses, and aquatic habitats.
- Reviewing status of State and regional water plans, forest and watershed health plans, and integrated regional water planning efforts.

## Anticipating Increased Forest Recreation Use

The use of the Coronado National Forest as a haven from summer heat and for water-related recreation continues to grow with population increases throughout the region. Planning for recreation should take into account the possible expansion of demand as temperatures increase and precipitation decreases because of climate change. This may affect recreation facilities, like campgrounds and boating facilities, as well as access to lakes and other water features. Analysis of both potential snowfall and future winter temperature changes may need to be conducted for consideration of additions to, or new construction of, skiing and other snow-based recreation activities.

## Monitoring Climate Change Influences and the Effectiveness of Adaptation Strategies

It is not recommended that the Coronado National Forest create a completely new initiative or program of work solely for monitoring climate change. However, consideration of appropriate adjustments to the monitoring program to improve understanding of the relationships of key plan components and climate change may be needed. As the Coronado National Forest reviews their existing and potential research natural areas, monitoring of climate change effects on specific ecosystems should be part of the research goals considered when building the research natural area establishment record.

When new tactics are employed to address climate change-related issues, it is also important to monitor the effectiveness of these actions. Monitoring information on the effectiveness of adaptation strategies can help the Coronado National Forest make adjustments when necessary or determine if a tactic might be worth replicating elsewhere.

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## Climate Change Glossary

The following terms have been gathered by U.S. Forest Service researchers from numerous sources including the National Oceanic and Atmospheric Administration (NOAA), Intergovernmental Panel on Climate Change (IPCC), and others. Included are the most commonly referred to terms in climate change literature and news media. This is only a partial list of terms associated with climate change. See other NOAA or IPCC documents for full glossaries associated with this topic.

**Anthropogenic emissions:** Emissions of greenhouse gases, greenhouse gas precursors, and aerosols associated with human activities. These include burning of fossil fuels for energy, deforestation, and land use changes that result in net increase in emissions.

**Arid regions:** Ecosystems with less than 250 mm precipitation per year.

**Atmosphere:** The gaseous envelope surrounding the Earth. The dry atmosphere consists almost entirely of nitrogen (78.1 percent volume mixing ratio) and oxygen (20.9 percent volume mixing ratio), together with a number of trace gases, such as argon (0.93 percent volume mixing ratio), helium, and radiatively active greenhouse gases such as carbon dioxide (0.035 percent volume mixing ratio) and ozone. In addition, the atmosphere contains water vapor, whose amount is highly variable but typically 1 percent volume mixing ratio. The atmosphere also contains clouds and aerosols.

**Biodiversity:** The numbers and relative abundances of different genes (genetic diversity), species, and ecosystems (communities) in a particular area.

**Carbon dioxide:** A naturally occurring gas, and also a byproduct of burning fossil fuels and biomass, as well as land use changes and other industrial processes. It is the principal human-caused greenhouse gas that affects the Earth's radiative balance. It is the reference gas against which other greenhouse gases are measured and, therefore, has a Global Warming Potential of 1.

**Carbon dioxide fertilization:** The enhancement of the growth of plants as a result of increased atmospheric carbon dioxide concentration. Depending on their mechanism of photosynthesis, certain types of plants are more sensitive to changes in atmospheric carbon dioxide concentration.

**Climate:** Climate may be defined as the "average weather," or more rigorously, as the statistical description of weather in terms of the mean and variability of relevant quantities (such as temperature, precipitation, or wind) over a period ranging from months to thousands or millions of years. The standard period is 30 years, as defined by the World Meteorological Organization (WMO). These quantities are often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the statistical description of the state or condition of the climate system.

**Climate change:** Climate change refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or external forces, or to persistent human-caused changes in the composition of the atmosphere or in land use. Note that the United Nations Framework Convention on Climate Change (UNFCCC), in its Article 1, defines "climate change" as: "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods." The UNFCCC thus makes a distinction between "climate change" attributable to human activities altering the atmospheric composition, and "climate variability" attributable to natural causes. See also climate variability.

**Climate feedback:** An interaction mechanism between processes in the climate system is called a climate feedback, when the result of an initial process triggers changes in a second process that in turn influences the initial one. A positive feedback intensifies the original process, and a negative feedback reduces it.

**Climate model (hierarchy**): A numerical representation of the climate system based on the physical, chemical, and biological properties of its components, their interactions and feedback processes, and accounting for all or some of its known properties. The climate system can be

represented by models of varying complexity—that is, for any one component or combination of components a "hierarchy" of models can be identified, differing in such aspects as the number of spatial dimensions, the extent to which physical, chemical, or biological processes are explicitly represented, or the level at which empirical parametrizations are involved. Coupled atmosphere/ocean/sea-ice general circulation models provide a comprehensive representation of the climate system. There is an evolution toward more complex models with active chemistry and biology. Climate models are applied, as a research tool, to study and simulate the climate, but they are also for operational purposes including monthly, seasonal, and inter-annual climate predictions.

**Drought:** There is no definitive definition of drought based on measurable processes. Instead, scientists evaluate precipitation, temperature, and soil moisture data for the present and recent past to determine drought status. Very generally, it refers to a period of time when precipitation levels are low, impacting agriculture, water supply, and wildfire hazard.

**El Niño:** In its original sense, El Niño is warm water current that periodically flows along the coast of Ecuador and Peru, disrupting the local fishery. This oceanic event is associated with a fluctuation of the inter-tropical surface pressure pattern and circulation in the Indian and Pacific Oceans, called the Southern Oscillation. This coupled atmosphere-ocean phenomenon is collectively known as El Niño Southern Oscillation. During an El Niño event, the prevailing trade winds weaken and the equatorial countercurrent strengthens, causing warm surface waters in the Indonesian area to flow eastward to overlie the cold waters of the Peru current. This event has great impact on the wind, sea surface temperature, and precipitation patterns in the tropical Pacific. It has climatic effects throughout the Pacific region and in many other parts of the world. The opposite of an El Niño event is called La Niña.

**Extreme weather event:** An extreme weather event is an event that is rare within its statistical reference distribution at a particular place. Definitions of "rare" vary, but an extreme weather event would normally be as rare as or rarer than the $10^{th}$ or $90^{th}$ percentile. By definition, the characteristics of what is called extreme weather may vary from place to place. An extreme climate event is an average of a number of weather events over a certain period of time, an average, which is itself extreme (such as rainfall over a season).

**Greenhouse effect:** Greenhouse gases effectively absorb infrared radiation, emitted by the Earth's surface, by the atmosphere itself due to the same gases, and by clouds. Atmospheric radiation is emitted to all sides, including downward to the Earth's surface. Thus, greenhouse gases trap heat within the surface-troposphere system. This is called the "natural greenhouse effect." Atmospheric radiation is strongly coupled to the temperature of the level at which it is emitted. In the troposphere, the temperature generally decreases with height. Effectively, infrared radiation emitted to space originates from an altitude with a temperature of, on average, -19 degrees Celsius, in balance with the net incoming solar radiation, whereas the Earth's surface is kept at a much higher temperature of, on average, +14 degrees Celsius. An increase in the concentration of greenhouse gases leads to an increased infrared opacity of the atmosphere and, therefore, to an effective radiation into space from a higher altitude at a lower temperature. This causes a radiative forcing, an imbalance that can only be compensated for by an increase of the temperature of the surface-troposphere system. This is the "enhanced greenhouse effect."

**Greenhouse gas:** Gaseous constituents of the atmosphere, both natural and human-caused, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds. This property causes the greenhouse effect. Water vapor, carbon dioxide, nitrous oxide, methane, and ozone are the primary

greenhouse gases in the Earth's atmosphere. Moreover there are a number of entirely human-made greenhouse gases in the atmosphere, such as the halocarbons and other chlorine and bromine-containing substances, dealt with under the Montreal Protocol. Besides carbon dioxide, nitrous oxide, and methane, the Kyoto Protocol deals with the greenhouse gases sulfur hexafluorid, hydrofluorocarbons, and perfluorocarbons.

**Radiative forcing:** Changes in the energy balance of the Earth-atmosphere system in response to a change in factors such as greenhouse gases, land use change, or solar radiation. The climate system inherently attempts to balance incoming (light) and outgoing (heat) radiation. Positive radiative forcings increase the temperature of the lower atmosphere, which in turn increases temperatures at the Earth's surface. Negative radiative forcings cool the lower atmosphere. Radiative forcing is most commonly measured in units of watts per square meter.

**Rangeland:** Undeveloped land that is suitable for use by wildlife and domestic ungulates.

**Rapid climate change:** The nonlinearity of the climate system may lead to rapid climate change, sometimes called abrupt events or even surprises. Some such abrupt events may be imaginable, such as a dramatic reorganization of the thermohaline circulation, rapid deglaciation, or massive melting of permafrost leading to fast changes in the carbon cycle. Others may be truly unexpected, as a consequence of a strong, rapidly changing, forcing of a nonlinear system.

**Regeneration:** The renewal of a stand of trees through either natural means (seeded onsite or adjacent stands or deposited by wind, birds, or animals) or artificial means (by planting seedlings or direct seeding).

**Teleconnections:** Atmospheric interactions between widely separated regions that have been identified through statistical correlations (in space and time). For example, the El Niño teleconnection with the Southwest United States involves large-scale changes in climatic conditions that are linked to increased winter rainfall.

**Weather:** Describes the daily conditions (individual storms) or conditions over several days (week of record-breaking temperatures) to those lasting less than 2 weeks.

# Appendix B. Proposed and Probable Management Practices

## Introduction

This appendix describes proposed and probable management practices that may take place on the Coronado National Forest at the project or activity level during the planning period to help maintain existing conditions or achieve the desired conditions described in the plan. These practices are not intended to be all-inclusive, nor are they intended to be decisions. They are simply projections of what actions may take place in the future. A plan amendment is not required to change or modify any of these proposed practices; instead, they can be updated at any time through an administrative correction of the plan.

## Management Approaches

Management approaches are not part of the plan components or decisions but are expressions of intent for how the Coronado National Forest will likely apply aspects of future management. Management approaches are also based on public feedback received on the plan regarding suggested methods for carrying out activities. Therefore, this section has been added to reflect our intent and those suggestions.

## Collaboration and Volunteers

There are many who have suggested that they would like to assist with aspects of national forest management. The Coronado National Forest intends to create increasing opportunities for volunteers and partners to be more active as part of national forest management. One area where this approach could work well is in natural resource and heritage education and interpretation. Citizen involvement would also benefit the Coronado National Forest by increasing contact with recreation visitors to encourage appropriate behavior. Assistance with plan monitoring is also a possibility. Finally, collaborative methods with interest groups and volunteers are ideally suited to addressing the problem of dumping trash, appliances, etc., on the Coronado National Forest, including the collecting and disposing of dumped material.

The Coronado National Forest benefits significantly from the contributions of volunteers and numerous non-profit organizations of which many organized to serve specific management areas of the national forest. Collaborative efforts focused on improving volunteer services, expanding environmental education, and enhancing the Forest's visitor centers will increase effective management of the Coronado and provide needed resources to accomplish the Forest's desired outcomes. Increased emphasis of engaging new audiences, welcoming community involvement, and striving to improve customer satisfaction will help promote public understanding, appreciation, and actions to protect our natural and cultural heritage.

## Cooperation with Tribal Groups and Agencies

### Cultural Resources

Most heritage resource management is guided by laws, existing regulations, and Forest Service policy. For that reason, few plan components are found in the revised plan that relate to such management. Heritage resources management will be consistent with the State cultural resource

plan and planning activities of the State Historic Preservation Office, as well as coordination with other Tribal, State, and Federal agencies. This could include periodic meetings, data sharing, coordination on National Register nominations, interpretation, site protection, and participation in the State heritage resources planning process. In addition, American Indian Tribes, communities, and nations will be consulted when heritage resources may be present that have religious or traditional cultural values for living communities of American Indian Tribes. These communities or Tribes will be consulted concerning location and importance of those resources and alternatives for protecting them.

### Bureau of Land Management

Arizona is 1 of 19 states where one may locate mining claims or sites. The Forest Service manages minerals found on the surface of National Forest System lands and the Bureau of Land Management (BLM) is responsible for subsurface minerals on National Forest System and BLM lands. Therefore, if the Forest Service desires to have an area withdrawn from mineral entry, it requests such a closure from the BLM. Examples of areas that are withdrawn from mineral entry include a designated wilderness, a portion of a designated wild and scenic river, or a designated recreation area. For areas not withdrawn, the Forest Service may apply mitigations for mining, but it may not prohibit mining.

### Arizona Game and Fish Department, New Mexico Department of Game and Fish, and U.S. Fish and Wildlife Service

The Arizona Game and Fish Department and New Mexico Department of Game and Fish directly manage wildlife populations in their respective States, while the Forest Service manages wildlife habitat on National Forest System lands. The U.S. Fish and Wildlife Service is the agency responsible for overseeing the management of federally designated special status animal and fish species and their habitats in accordance with the Endangered Species Act. The Coronado National Forest will cooperate with one or both of these agencies in order to carry out management activities. For example, management of native fish could involve removal of nonnative species, as well as adjustments in habitat, which could require working with the States or U.S. Fish and Wildlife Service. The Coronado National Forest also expects to coordinate with the States in development of wildlife linkages (movement corridors) within the Coronado National Forest so that local populations of species, such as northern goshawks, remain viable where habitat is being fragmented. Finally, the Coronado National Forest intends to facilitate partnerships that lead to maintenance of year-round water structures for wildlife.

## Cooperation with Local Partners

The Coronado National Forest has ongoing collaborative relationships with communities and groups with land management interests in the geographic area of the national forest. Members of local groups have participated in the plan revision process from its inception, and the Coronado staff will continue this collaborative effort in the future to implement monitoring and other common goals. Coronado personnel participate in the scheduled meetings of partner groups, their events, and other ongoing partner activities. Coordinating with these groups promotes and develops consistency among resource plans and integrates common land management goals and strategies. The following are examples of participating partner groups.

### Arizona Sky Island Alliance

Sky Island Alliance is a grassroots organization dedicated to the protection and restoration of the rich natural heritage of native species and habitats in the sky island region of the Southwestern

United States and northwestern Mexico. They work with volunteers, scientists, landowners, public officials, and government agencies to establish protected areas, restore healthy landscapes, and promote public appreciation of the region's unique biological diversity.

### Coronado Planning Partnership

The Coronado Planning Partnership promotes the protection of wild species, their habitats, and ecological communities, as well as the processes that sustain them, on the Coronado National Forest. The partnership was formed in 2006 in response to the Coronado's initiation of the plan revision. To accomplish their goals for the benefit of future generations, the partnership mobilizes a wide range of individuals and groups on behalf of their shared stake in the national forest to ensure conservation-based management. The organization has worked with the Coronado National Forest in the development, outcome, implementation, and long-term monitoring of the revised forest plan.

### Sonoita Valley Planning Partnership

The Sonoita Valley Planning Partnership is a voluntary association of agencies (Federal, State, and local), organized groups, and individuals who share a common interest in the future of public land resources in the Sonoita Valley. Participating individuals come from a variety of communities including Sonoita, Elgin, Patagonia, Huachuca City, Sierra Vista, Nogales, Tucson, and Phoenix. Participation also comes from representatives of organized groups including hiking clubs, conservation organizations, off-highway vehicle clubs, mountain bike clubs, bird-dog clubs, and grazing and mining interests. The partnership was established as a way for the collective community to come together to achieve community-oriented resolutions to local and national issues affecting public lands within the Sonoita Valley (Cienega Creek watershed south of Interstate 10 and small portions of the upper watersheds of Sonoita Creek and the Babocomari River).

### Cienega Corridor Conservation Council

The Cienega Corridor Conservation Council was established to protect, steward, and enhance the cultural and natural resources of the Cienega Corridor. The Cienega Corridor is defined as the area linking Saguaro National Park and the Coronado National Forest Rincon Wilderness to Las Cienegas National Conservation Area.

### Cienega Watershed Partnership

The Cienega Watershed Partnership was established in 2005 to sustain the watershed. This organization acts in partnership with landowners and managers to facilitate cooperative actions that steward the natural and cultural resources of the Cienega watershed while enabling sustainable human use. The Partnership collaborates with partners and involves stakeholders to encourage an ecosystem approach to sustainable use based on active stewardship, adaptive management practices, and science-based actions.

### Cochise County Public Lands Advisory Committee

Established by the Cochise County Board of Supervisors in 2007, the Cochise County Public Lands Advisory Committee advises the board on matters related to Federal and State lands within Cochise County. The committee develops and reviews plans and policies related to State and Federal management plans. The goal is to collaborate closely with Federal agencies in the development of consistent land management policies.

# Probable Projects

## Plan Objectives

The objectives in the chapters titled “Forestwide Management” (chapter 2), “Management Areas” (chapter 3), and “Geographic Areas” (chapter 4) represent proposed projects or activities intended to be accomplished over the life of the plan. These are outlined in the table below.

**Table 20. List of plan objectives**

| Project or Activity | Timeframe to Complete |
|---|---|
| **Vegetation** | |
| Treat 5,000 to 10,000 acres in the wildland-urban interface using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication every year to reduce fire hazard and risk to communities and the national forest. | 10-year period following plan approval |
| Suppress or eradicate buffelgrass on at least 5,000 acres of Sonoran Desert using herbicides and manual methods. | 10-year period following plan approval |
| Treat at least 72,500 acres of grasslands using wildland fire (planned and unplanned ignitions), thinning, and mastication. | 10-year period following plan approval |
| Treat at least 5,000 acres of interior chaparral using wildland fire (planned and unplanned ignitions), thinning, and mastication. | 10-year period following plan approval |
| Treat at least 367,000 acres of Madrean encinal woodland using wildland fire (planned and unplanned ignitions), thinning, and mastication. | 10-year period following plan approval |
| Treat at least 25,000 acres of Madrean pine-oak woodlands using wildland fire (planned and unplanned ignitions), thinning, and mastication. | 10-year period following plan approval |
| Treat at least 12,500 acres of ponderosa pine-evergreen shrub using wildland fire (planned and unplanned ignitions), thinning, and mastication. | 10-year period following plan approval |
| Treat at least 13,800 acres of dry mixed-conifer using wildland fire (planned and unplanned ignitions), thinning, and mastication. | 10-year period following plan approval |
| Treat at least 2,400 acres of wet mixed-conifer using wildland fire (planned and unplanned ignitions), thinning, and mastication. | 10-year period following plan approval |
| Restore native vegetation and natural waterflow patterns on at least 10 wetland sites. | 10-year period following plan approval |
| Realign or remove 2 miles of roads in wetlands or meadows. | 10-year period following plan approval |
| Treat 200 to 1,000 acres of exotic invasive grass populations (primarily buffelgrass and fountain grass) on the southwest slopes of the Pusch Ridge Wilderness. | Annually following plan approval |
| Treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 20 percent of the Chiricahua and Santa Rita Ecosystem Management Areas to create resiliency to disturbances. Treatments will be consistent with the objectives for forestwide vegetation communities and resources. | 10-year period following plan approval |
| Treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 15 percent of the Dragoon and Whetstone Ecosystem Management Areas to create resiliency to disturbances. Treatments will be consistent with the objectives for forestwide vegetation communities and resources. | 10-year period following plan approval |

| Project or Activity | Timeframe to Complete |
|---|---|
| Treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 35 percent of the Peloncillo Ecosystem Management Area to create resiliency to disturbances. Treatments will be consistent with the objectives for forestwide vegetation communities and resources. | 10-year period following plan approval |
| Treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 10 percent of the Winchester Ecosystem Management Area to create resiliency to disturbances. Treatments will be consistent with the objectives for forestwide vegetation communities and resources. | 10-year period following plan approval |
| Treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 25 percent of the Pinaleño, Tumacacori, Santa Catalina, and Huachuca Ecosystem Management Areas to create resiliency to disturbances. Treatments will be consistent with the objectives for forestwide vegetation communities and resources. | 10-year period following plan approval |
| Treat the vegetation using wildland fire (planned and unplanned ignitions), prescribed cutting, and mastication on at least 40 percent of the Galiuro and Santa Teresa Ecosystem Management Areas to create resiliency to disturbances. Treatments will be consistent with the objectives for forestwide vegetation communities and resources. | 10-year period following plan approval |
| **Recreation and Scenic Quality** | |
| Reduce the backlog of recreation deferred maintenance in developed sites by 20 percent. | 5-year period following plan approval |
| Retrofit or install wildlife-resistant trash cans at all developed recreation areas and wildlife-resistant food storage boxes at all developed campgrounds. | 10-year period following plan approval |
| Phase out permits for isolated cabins, privately owned buildings, and residences that are not part of the recreation residence program. | To be completed by 2028 |
| Remove trash along 4 miles of National Forest System trails within the Chiricahua Wilderness. | Annually following plan approval |
| Remove trash along 5 miles of National Forest System trails and restore 1 mile of user-created trails to a condition where it is not noticeable to visitors within the Miller Peak Wilderness. | Annually following plan approval |
| Restore 1 mile of user-created trails to a condition where it is not noticeable to visitors. | Annually following plan approval |
| Remove trash along 3 miles of National Forest System trails within the Mount Wrightson Wilderness. | Annually following plan approval |
| Remove trash along 1 mile of National Forest System trails within the Pajarita Wilderness. | Annually following plan approval |
| **Watershed Integrity** | |
| Treat 2,500 to 10,000 acres of uplands with vegetation treatments or soil and watershed restoration treatments to maintain watershed stability and, thereby, the structure and function of streams, flood plains, and riparian vegetation. | 10-year period following plan approval |
| Enhance or restore 2,500 to 15,000 acres of uplands with vegetation treatments or soil and watershed restoration treatments to attain necessary ground cover by litter and ground cover by plant basal area. | 10-year period following plan approval |

| Project or Activity | Timeframe to Complete |
|---|---|
| **Aquatic and Terrestrial Wildlife Habitat** | |
| Complete three stream restoration and/or development projects to benefit aquatic species of conservation concern. | 10-year period following plan approval |
| Install an average of two wildlife-friendly closures at mines, caves, or adits each year. | 10-year period following plan approval |
| Apply for at least 10 instream flow water rights on streams for recreation and wildlife purposes, prioritizing locations necessary for sustaining native fish populations and species of conservation concern. | 10-year period following plan approval |
| Reconstruct at least three developed springs to provide aquatic habitat for the recovery of plant and/or animal species. | 10-year period following plan approval |
| Install wildlife escape ramps in all aboveground constructed waters. | 10-year period following plan approval |
| Install at least one hardened road surface each year at drainage crossings where erosion, sedimentation, or risks to water quality from road-stream crossings are affecting wildlife habitat in order to prevent downstream effects. | Annually following plan approval |
| **Open Space, Land Adjustment, Transportation, and Access** | |
| Increase the number of permanent legal access routes to and within the Coronado National Forest by resolving the legal status deficiencies of 40 to 50 existing and proposed forest roads and trails, using a variety of methods. | 10-year period following plan approval |
| Complete maintenance on at least 150 miles of high-clearance (maintenance level 2) roads. | Annually following plan approval |
| Complete maintenance on at least 200 miles of passenger car (maintenance levels 3, 4, and 5) roads based on a safety prioritization. | Annually following plan approval |
| Decommission, close, and restore 3 to 10 miles of unneeded nonsystem roads, except for roads identified for potential public access routes. | Annually following plan approval |
| **Cultural Resources and Tribal Relations** | |
| Complete 200 acres of nonproject inventory, so that the Coronado's currently unidentified cultural resources can be recorded, evaluated, and protected. | Annually following plan approval |
| Nominate at least five individual sites or at least two districts to the National Register of Historic Places. | 10-year period following plan approval |
| Conduct stabilization or preservation activities at one or more priority heritage assets. | Annually following plan approval |
| Complete Native American Graves Protection and Repatriation Act (NAGPRA) repatriations of all items collected prior to 1990. | 5-year period following plan approval |
| Host, sponsor, or participate in at least two interpretive event for the public. | Annually following plan approval |
| Provide opportunities for volunteers to participate in cultural resource conservation activities at two to five archaeological sites or historic properties. | Annually following plan approval |
| Enter at least two historic sites in the Arizona "Rooms with a View" cabin rental program. | 10-year period following plan approval |
| Inspect each priority heritage asset one or more times. | 5-year period following plan approval |

## Resource Advisory Committee

The Southern Arizona Resource Advisory Committee was formed in 2010 as a part of the Secure Rural Schools and Community Self-Determination Act of 2000 and as amended in 2008 (P.L.

110-343). The Southern Arizona Resource Advisory Committee makes project recommendations for four districts of the Coronado and a portion of the Tonto National Forest. The Eastern Arizona Resource Advisory Committee includes the Coronado's Safford Ranger District. The committee recommends projects for Federal funds that benefit resources on public lands. Per the requirements of the Secure Rural Schools and Community Self-Determination Act, a project can be funded if it is compliant with laws and regulations, consistent with the forest plan, and properly submitted and recommended by the Resource Advisory Committee. Project objectives may include maintenance or obliteration of roads, trails, and infrastructure; improvement of soil productivity; improvements in forest ecosystem health; restoration and maintenance of watersheds; control of noxious and exotic weeds; and reestablishment of native species. These projects improve cooperative relationships among those who manage, use, and care for the national forests.

The following table lists examples of Southern Arizona Resource Advisory Committee recommended projects. The needs for change reflect the five themes identified in the Comprehensive Evaluation Report and Analysis of the Management Situation: (1) ecosystem restoration and resiliency, (2) visitor experience, (3) access to National Forest System lands, (4) preservation of open space, and (5) communities, collaboration and partnerships.

**Table 21. Examples of projects recommended by the Resource Advisory Committee**

| Type of Project | Description | Needs for Change Addressed* |
|---|---|---|
| Ecological restoration | Promoting community protection, fuels treatment (mechanical treatment or broadcast burning) will reduce the risk of extreme wildfire at two sites. Other project objectives are watershed protection, wildlife habitat improvement, and ecosystem health improvement. | 1, 4, 5 |
| Control of invasive plants | Work crews and herbicides will be used to reduce infestations of exotic, invasive plants, primarily bufflegrass and fountain grass on the Santa Catalina and Nogales Ranger Districts. This is part of active collaboration with Pima County, Saguaro National Park, the University of Arizona, and the Southern Arizona Bufflegrass Coordination Center. | 1, 2, 4, 5 |
| Road maintenance in Cochise County | Turnouts, culverts, drainage ditches, and surfacing will be installed to provide safe, sustainable, and maintainable access to areas throughout the Sierra Vista Ranger District. | 1, 2, 3 |
| Road improvement | One half mile of Brown Canyon Ranch road will be rerouted to allow passenger car access to this historic ranch on the southwestern edge of Sierra Vista. The ranch provides recreation opportunities and serves as the site for the Western Heritage Education Program. The project also improves the surrounding ephemeral wetland. | 1, 2, 3, 4, 5 |
| Trail maintenance | This project establishes two Forest Service crews, based out of Tucson and Douglas, to maintain existing backcountry trail networks. Additionally, trail maintenance creates proper drainage to reduce erosion, ensures trail signs are accurate and repaired, and backcountry springs are functioning. | 1, 2, 3 |
| Arizona Trail trailhead development | In coordination with volunteer groups and the Coronado, Pinal County is constructing three new trailheads that will add access points for Arizona Trail users to explore the adjoining Coronado National Forest on the south and the Tonto National Forest on the north. | 1, 2, 3, 4, 5 |

| Type of Project | Description | Needs for Change Addressed* |
|---|---|---|
| Arizona Trail rehabilitation | A Coconino Rural Environment Corp crew will rehabilitate 4.5 miles of the Arizona Trail from Sunnyside Canyon to Miller Peak. This provides maintainable access to the Arizona Trail at the south end of the trail to the Miller Peak Wilderness. | 1, 2, 3, 5 |
| Fence reconstruction | Arizona Department of Corrections crews will install new barbed wire fencing damaged or destroyed by the Horseshoe II Fire in the Chiricahua Mountains. This project will promote burned area recovery and contain livestock. | 1, 4, 5 |
| Well rehabilitation | With technical assistance from the Natural Resources Conservation Service, this project will install a solar pumping plant that includes solar panels and a submersible pump on an existing Nogales Ranger District well. The well will improve livestock and wildlife use and distribution through improving existing infrastructure and adding new watering facilities. | 1, 4 ,5 |
| CCC house restoration | Local contractors will restore a Civilian Conservation Corps era house at the Portal Ranger Station to modern standards of safety and accessibility. This house in the Chiricahua Mountains will then become part of the “Rooms With a View” cabin rental program. This program allows the public to stay in historic Forest Service buildings in unique environments for a nominal fee. | 2, 3, 5 |
| Endangered fish and frog facility (T&E species) | Volunteers, corporate donations, and the U.S. Fish and Wildlife Service partnered with the Douglas Ranger District to promote a working research and study pond for public school students grades K-12. The project is restructuring a facility bringing it back into production mode. The pond houses Yaqui Chub and Yaqui Topminnow fish, and includes two ranariums for Chiricahua Leopard frogs. | 1, 5 |

* 1 = ecosystem restoration and resiliency, 2 = visitor experience, 3 = access to National Forest System lands, 4 = preservation of open space, and 5 = communities, collaboration and partnerships.

# Appendix C. Communications Sites

The following are designated communications sites to be administered per Forest Service Manual direction. Some sites are for governmental administration and not for commercial use. Future development at all sites should adhere to direction in the communications site plan approved for each site.

**Table 22. Communications sites on the Coronado National Forest**

| Site Name | District | Administrative | Commercial | Low Power or High Power |
|---|---|---|---|---|
| Dragoon | Douglas | No | Yes | Low |
| Elephant Head | Nogales | No | Yes | High |
| Melendrez Pass | Nogales | No | Yes | Low & High |
| Mount Hopkins | Nogales | Yes | Yes | Low |
| Red Mountain | Sierra Vista | Yes | No | Low |
| Heliograph | Safford | No | Yes | Low |
| Ladybug | Safford | No | Yes | Low |
| GATR | Santa Catalina | Yes | No | Low |
| Mount Bigelow | Santa Catalina | No | Yes | High |
| Radio Ridge | Santa Catalina | Yes | Yes | Low |
| Soldier Peak | Santa Catalina | Yes | No | Low |

# Appendix D. Animal and Plant Species

**Table 23. Plant and animal species common and scientific names**

| Plant or Animal Common Name | Plant or Animal Scientific Name | Taxa Group |
|---|---|---|
| none | *Mannia californica* | mosses and liverworts |
| none | *Plagiochasma wrightii* | mosses and liverworts |
| Abert's squirrel | *Sciurus aberti* | mammal |
| acalypha | *Acalypha amentacea Roxb.* ssp. *wilkesiana* | plant |
| acorn woodpecker | *Melanerpes formicivorus* | bird |
| agave | *Agave* spp. | plant |
| alder | *Alnus* spp. | plant |
| Allen's big-eared bat | *Idionycteris phyllotis* | mammal |
| alligator juniper | *Juniperus deppeana Steud.* | plant |
| alpine clover | *Trifolium* spp. | plant |
| American badger | *Taxidea taxus* | mammal |
| American black bear | *Ursus americanus* | mammal |
| annual sunflower | *Helianthus annuus* | plant |
| Apache pine | *Pinus engelmannii Carrière* | plant |
| Apache trout | *Oncorhynchus gilae apachae* | fish |
| Aravaipa woodfern | *Thelypteris puberula var. sonorensis* | plants |
| Arizona ash | *Fraxinus* spp. | plant |
| Arizona black rattlesnake | *Crotalus cerberus* | reptile |
| Arizona cypress | *Hesperocyparis arizonica* | plant |
| Arizona eryngo | *Eryngium sparganophyllum* | plant |
| Arizona eyed click beetle | *Alaus lusciosus* | invertebrate |
| Arizona fescue | *Festuca arizonica Vasey* | plant |
| Arizona gray squirrel | *Sciurus arizonensis* | mammal |
| Arizona madrone | *Arbutus arizonica* | plant |
| Arizona Manihot | *Manihot davisiae* | plants |
| Arizona muhly | *Muhlenbergia arizonica* | plant |
| Arizona oak | *Quercus arizonica* | plant |
| Arizona sycamore | *Platanus wrightii* | plant |
| Arizona treefrog | *Hyla wrightorum* | amphibian |
| Arizona walnut | *Juglans major* | plant |
| Arizona white oak | *Quercus arizonica Sarg* | plant |
| Arizona wildrye | *Elymus arizonicus* | plant |
| arroyo willow | *Salix lasiolepis* | plant |
| aspen | *Populus tremuloides* | plant |
| Atlantis fritillary butterfly | *Speyeria altantis* | invertebrate |
| ayenia | *Ayenia* spp. | plant |

| Plant or Animal Common Name | Plant or Animal Scientific Name | Taxa Group |
|---|---|---|
| bahia | *Bahia* spp. | plant |
| banana yucca | *Yucca baccata* | plant |
| barking frog | *Craugastor augusti* | reptile |
| barrel cactus | *Ferocactus* spp. | plant |
| bats | *Order Chiroptera* | mammal |
| beardless chinch weed | *Pectis imberbis* | plants |
| beargrass | *Nolina* spp. | plant |
| beggartick threeawn | *Aristida Orcuttiana* | plant |
| big bursage | *Ambrosia ambrosioides* | plant |
| bigtooth maple | *Acer granditentatum* | plant |
| birchleaf buckthorn | *Frangula betulifolia* | plant |
| birchleaf mountain mahogany | *Cercocarpus montanus Raf.* var. *glaber* | plant |
| black grama | *Bouteloua eriopoda* | plant |
| black-necked gartersnake | *Thamnophis cyrtopsis* | reptile |
| black-tailed jackrabbit | *Lepus californicus* | mammal |
| black-tailed rattlesnake | *Crotalus molossus* | reptile |
| black-throated sparrow | *Amphispiza bilineata* | bird |
| bladderpod | *Lesquerella* spp. | plant |
| blue curls | *Trichostema* spp. | plant |
| blue grama | *Bouteloua gracilis* | plant |
| blue paloverde | *Parkinsonia florida* | plant |
| blue penstemon | *Penstemon cyaneus* | plant |
| blue threeawn | *Aristida purpurea Nutt.* var. *nealleyi* | plant |
| bluedicks | *Dichelostemma capitatum* | plant |
| border piñon | *Pinus discolor* | plant |
| Botteri's sparrow | *Aimophila botterii* | bird |
| bottlebrush squirreltail | *Elymus elymoides ssp. elymoides* | plant |
| bouvardia | *Bouvardia salisb.* | plant |
| box elder | *Acer negundo L.* | plant |
| brittlebush | *Encelia Adans.* | plant |
| broad-billed hummingbird | *Selasphorus platycercus* | bird |
| broad-leaf ground-cherry | *Physalis latiphysa* | plants |
| brown creeper | *Certhia americana* | bird |
| buffalo gourd | *Cucurbita foetidissima* | plant |
| bufflegrass | *Pennisetum ciliare* | plant |
| bulb panic | *Panicum bulbosum Kunth* | plant |
| bullgrass | *Muhlenbergia emersleyi Vasey* | plant |
| bulrush | *Scirpus L.* | plant |
| bundleflower | *Desmanthus Willd.* | plant |
| burrobrush | *Hymenoclea salsola* var. *salsola* | plant |

| Plant or Animal Common Name | Plant or Animal Scientific Name | Taxa Group |
|---|---|---|
| bush muhly | *Muhlenbergia porteri Scribn. ex Beal* | plant |
| cactus wren | *Campylorhynchus brunneicapillus* | bird |
| California brickellbush | *Brickellia Californica* | plant |
| camphor weed | *Pluchea camphorata* | plant |
| canaigre | *Rumex hymenosepalus Torr.* | plant |
| cane beardgrass | *Bothriochloa barbinodis* | plant |
| Canelo Hills ladies' tresses | *Spiranthes delitescens* | plant |
| canyon spotted whiptail | *Aspidoscelis burti* | reptile |
| canyon wren | *Catherpes mexicanus* | bird |
| cave-obligate pseudoscorpion | *Tuberochernes ubicki* | invertebrate |
| catclaw acacia | *Acacia greggii A. Gray* | plant |
| catclaw mimosa | *Mimosa aculeaticarpa* | plant |
| ceanothus | *Ceanothus L.* | plant |
| checkered gartersnake | *Thamnophis marcianus* | reptile |
| Chihuahuan pine | *Pinus leiophylla Schiede & Deppe* | plant |
| Chiricahua leopard frog | *Lithobates chiricahuensis* | amphibian |
| Chiricahua fleabane | *Erigeron kuschei* | plants |
| Chiricahua gentian | *Gentianella wislizeni* | plants |
| Chiricahua mudwort | *Limosella pubiflora* | plants |
| Chiricahua white | *Neophasia terlootii* | invertebrate |
| Chisos coralroot | *Hexalectris colemanii* | plants |
| cholla | *Cylindropuntia* spp. | plant |
| Clark's nutcracker | *Nucifraga columbiana* | bird |
| Clark's spiny lizard | *Sceloporus clarkii* | reptile |
| clematis | *Clematis* spp. | plant |
| cliff muhly | *Muhlenbergia polycaulis Scribn.* | plant |
| cliffrose | *Purshia* spp. | plant |
| club moss | *Lycopodium* | plant |
| Cochise woolwort | *Laennecia eriophylla* | plants |
| collared peccary | *Pecari tajacu* | mammal |
| columbine | *Aquilegia L.* | plant |
| common hog-nosed skunk | *Conepatus leuconotus* | mammal |
| condalia | *Condalia spathulata A. Gray* | plant |
| copper mine milk-vetch | *Astragalus cobrensis var. maguirei* | plants |
| coralbean | *Erythrina flabelliformis Kearney* | plant |
| cordilleran flycatcher | *Empidonax occidentalis* | bird |
| corkbark fir | *Abies lasiocarpa* var. *arizonica* | plant |
| Couch's spadefoot | *Scaphiopus couchii* | amphibian |
| Coues' white-tailed deer | *Odocoileus virginianus couesii* | mammal |
| coursetia | *Coursetia glandulosa* | plant |

| Plant or Animal Common Name | Plant or Animal Scientific Name | Taxa Group |
|---|---|---|
| coyote melon | *Cucurbita palmata* | plant |
| coyote willow | *Salix exigua* | plant |
| creeping mahonia | *Mahonia repens* | plant |
| creosote bush | *Larrea tridentata* | plant |
| crinkleawn | *Trachypogon* | plant |
| croton | *Croton* | plant |
| curly mesquite | *Hilaria belangeri* | plant |
| dalea | *Psorothamnus Rydb.* | plant |
| deergrass | *Muhlenbergia rigens* | plant |
| desert bighorn sheep | *Ovis canadensis mexicana* | mammal |
| desert broom | *Baccharis sarothroides A. Gray* | plant |
| desert ceanothus | *Ceanothus greggii A. Gray* | plant |
| desert grassland whiptail | *Aspidoscelis uniparens* | reptile |
| desert hackberry | *Celtis L.* | plant |
| desert honeysuckle | *Anisacanthus Nees* | plant |
| desert ironwood | *Olneya tesota A. Gray* | plant |
| desert orangetip | *Anthocharis cethura* | invertebrate |
| desert pupfish | *Cyprinodon macularius* | fish |
| desert senna | *Senna armata* | plant |
| desert spiny lizard | *Sceloporus magister* | reptile |
| desert tortoise | *Gopherus agassizi* | reptile |
| desert willow | *Chilopsis linearis* | plant |
| desert zinnia | *Zinnia acerosa* | plant |
| dock | *Rumex L.* | plant |
| dogweed | *Adenophyllum Pers.* | plant |
| Douglas-fir | *Pseudotsuga menziesii* | plant |
| eared quetzal | *Euptilotis neoxenus* | bird |
| eastern patch-nosed snake | *Salvadora grahamiae* | reptile |
| elegant trogon | *Trogon elegans* | bird |
| Elusive browallia | *Browallia eludens* | plants |
| Emory oak | *Quercus emoryi Torr.* | plant |
| Engelmann spruce | *Picea engelmannii Parry ex Engelm* | plant |
| evergreen sumac | *Rhus virens Lindh. ex A. Gray* | plant |
| evolvulous | *Evolvulus arizonicus* | plant |
| false hellebore | *Veratrum L.* | plant |
| false mesquite | *Calliandra eriophylla Benth.* | plant |
| feather dalea | *Dalea formosa* | plant |
| Fendler's buckbrush | *Ceanothus fendleri* | plant |
| ferns | *Pterophyta* | plant |
| flame sumac | *Rhus glabra L.* | plant |

| Plant or Animal Common Name | Plant or Animal Scientific Name | Taxa Group |
|---|---|---|
| flammulated owl | *Otus flammeolus* | bird |
| fluff grass | *Dasyochloa pulchella* | plant |
| foothill paloverde | *Parkinsonia L.* | plant |
| Fremont cottonwood | *Populus fremontii S. Watson* | plant |
| frogs and toads | *Order Anura* | amphibian |
| Gambel oak | *Quercus gambelii Nutt.* | plant |
| Gambel's quail | *Callipepla gambelli* | bird |
| gentian | *Gentiana L.* | plant |
| geranium | *Geranium L.* | plant |
| giant hairy scorpion | *Hadrurus arizonensis* | invertebrate |
| giant water bug | *Lethocerus medius* | invertebrate |
| Gila chub | *Gila intermedia* | fish |
| Gila monster | *Heloderma suspectum* | reptile |
| Gila spotted whiptail | *Aspidoscelis flagellicauda* | reptile |
| Gila topminnow | *Poeciliopsis occidentalis* | fish |
| Gila trout | *Oncorhynchus gilae* | fish |
| Gila woodpecker | *Melanerpes uropygialis* | bird |
| globe mallow | *Sphaeralcea ambigua A. Gray* | plant |
| goldeneye | *Viguiera Kunth* | plant |
| goldenrod | *Oreochrysum Rydb.* | plant |
| Goodding willow | *Salix gooddingii C.R. Ball* | plant |
| goosegrass | *Eleusine Gaertn.* | plant |
| Gould's wild turkey | *Meleagris gallopavo mexicana* | bird |
| Grace's warbler | *Dendroica graciae* | bird |
| gray fox | *Urocyon cinereoargenteus* | mammal |
| gray hawk | *Asturina nitida* | bird |
| gray oak | *Quercus grisea Liebm.* | plant |
| graythorn | *Ziziphus obtusifolia* | plant |
| Great Plains skink | *Plestiodon obsoletus* | reptile |
| Great Plains toad | *Anaxyrus cognatus* | amphibian |
| great purple hairstreak | *Atlides halesus* | invertebrate |
| greater short-horned lizard | *Phrynosoma hernadesi* | reptile |
| green ratsnake | *Senticolus triaspis* | reptile |
| green sprangletop | *Leptochloa dubia* | plant |
| Gregg's dalea | *Dalea versicolor Zucc.* | plant |
| groundsel | *Roldana Llave ex Lex.* | plant |
| hairy goldaster | *Heterotheca villosa* | plant |
| hairy grama | *Bouteloua hirsuta Lag.* | plant |
| Hall's panic | *Panicum hallii Vasey* | plant |
| hedgehog cactus | *Echinocereus Engelm* | plant |

| Plant or Animal Common Name | Plant or Animal Scientific Name | Taxa Group |
|---|---|---|
| hemlock-parsley | *Conioselinum Hoffm.* | plant |
| hepatic tanager | *Piranga flava* | bird |
| Hinkley's Jacob's ladder | *Polemonium pauciflorum hinckleyi* | plants |
| honeysuckle | *Anisacanthus Nees* | plant |
| Hopi tea | *Thelesperma megapotamicum* | plant |
| horse lubber grasshopper | *Taeniopoda eques* | invertebrate |
| Huachuca cinquefoil | *Potentilla rhyolitica var. rhyolitica* | plants |
| Huachuca giant skipper | *Agathymus evansi* | invertebrate |
| Huachuca milkvetch | *Astragalus hypoxylus* | plants |
| Huachuca springsnail | *Pyrgulopsis thompsoni* | invertebrate |
| Huachuca water umbel | *Lilaeopsis schaffneriana var. recurva* | plants |
| hummingbirds | *Family Trochilidae* | bird |
| iris (native) | *Iris L.* | plant |
| jaguar | *Panthera onca* | mammal |
| janusia | *Janusia A. Juss.* | plant |
| junegrass | *Koeleria Pers.* | plant |
| kidneywood | *Eysenhardtia Kunth* | plant |
| kit fox | *Vulpres macrotis* | mammal |
| leafy Jacob's ladder | *Polemonium foliosissimum var. flavum* | plants |
| lesser long-nosed bat | *Leptonycteris yerbabuenae* | mammal |
| lilies | *Lilium L.* | plant |
| limber bush | *Jatropha cuneata* | plant |
| littleleaf paloverde | *Parkinsonia L.* | plant |
| littleleaf sumac | *Rhus microphylla Engelm. ex A. Gray* | plant |
| loach minnow | *Tiaroga cobitis* | fish |
| long-legged myotis | *Myotis volans* | mammal |
| long-tailed vole | *Microtus longicaudus* | mammal |
| longtongue muhly | *Muhlenbergia longiligula Hitchc.* | plant |
| lotus | *Nelumbo lutea* | plant |
| lowland leopard frog | *Lithobates yavapaiensis* | amphibian |
| Madrean alligator lizard | *Elgaria kingii* | reptile |
| manzanita | *Arctostaphylos Adans.* | plant |
| mariola | *Parthenium incanum Kunth* | plant |
| mat muhly | *Muhlenbergia richardsonis* | plant |
| meadowrue | *Thalictrum* | plant |
| Mearn's sumac | *Rhus virens* var. *choriophylla* | plant |
| mesa threeawn | *Aristida ternipes* var. *gentilis* | plant |
| mesquite | *Prosopis L.* | plant |
| Mexican blue oak | *Quercus oblongifolia Torr.* | plant |
| Chiricahua squirrel | *Sciurus nayaritensis* | mammal |

| Plant or Animal Common Name | Plant or Animal Scientific Name | Taxa Group |
|---|---|---|
| Mexican gray wolf | *Canis lupus baileyi* | mammal |
| Mexican hog-nosed snake | *Heterodon kennerlyi* | reptile |
| Mexican jay | *Aphelocoma ultramarina* | bird |
| Mexican long-nosed bat | *Leptonycteris nivalis* | mammal |
| Mexican spotted owl | *Strix occidentalis lucida* | bird |
| mimosa | *Mimosa aculeaticarpa Ortega* | plant |
| monkey flowers | *Mimulus L.* | plant |
| Montezuma quail | *Cyrtonyx montezumae* | bird |
| mormon tea | *Ephedra viridis Coville* | plant |
| morning-glory | *Ipomoea L.* | plant |
| mosses | *Bryophyta* | plant |
| mountain mahogany | *Cercocarpus Kunth* | plant |
| mountain muhly | *Muhlenbergia montana* | plant |
| mountain skink | *Plestiodon callicephalus* | reptile |
| mountain snowberry | *Symphoricarpos oreophilus A. Gray* | plant |
| mountain snails | *genus Oreohelix* | invertebrate |
| Mount Graham red squirrel | *Tamiasciurus hudsonicus grahamensis* | mammal |
| mule ears | *Wyethia Nutt.* | plant |
| muttongrass | *Poa fendleriana* | plant |
| narrowleaf hoptree | *Ptelea trifoliata* ssp. *pallida* | plant |
| netleaf hackberry | *Celtis laevigata Willd.* var. *reticulata* | plant |
| netleaf oak | *Quercus rugosa Née* | plant |
| New Mexico bitterweed | *Hymenoxys ambigens* var. *neomexicana* | plants |
| New Mexico feathergrass | *Hesperostipa neomexicana* | plant |
| New Mexico locust | *Robinia neomexicana A. Gray* | plant |
| New Mexico ridge-nosed rattlesnake | *Crotalus willardi obscurus* | reptile |
| nodding brome | *Bromus anomalus Rupr. ex Fourn.* | plant |
| North American porcupine | *Erethizon dorsatum* | mammal |
| northern aplomado falcon | *Falco femoralis septentrionalis* | bird |
| northern goshawk | *Accipiter gentilis* | bird |
| Northern Mexican gartersnake | *Thamnophis eques megalops* | reptile |
| northern raccoon | *Procyon lotor* | mammal |
| ocelot | *Leopardus pardalis* | mammal |
| ocotillo | *Fouquieria splendens Engelm.* | plant |
| onion (native) | *Allium L.* | plant |
| Orcutt's threeawn | *Aristida schiedeana Trin. & Rupr.* var. *orcuttiana* | plant |
| painted redstart | *Myioborus pictus* | bird |
| Palmer oak | *Quercus palmeri* | plant |

| Plant or Animal Common Name | Plant or Animal Scientific Name | Taxa Group |
|---|---|---|
| Palmer's agave | *Agave palmeri* | plant |
| paperflower | *Psilostrophe DC* | plant |
| Parry's agave | *Agave parryi Engelm.* | plant |
| pectis | *Pectis angustifolia Torr.* var. *angustifolia* | plant |
| penstemon | *Penstemon* spp. | plant |
| pigweed | *Amaranthus L.* | plant |
| Pima pineapple cactus | *Coryphantha scheeri* var. *robustispina* | plant |
| pine dropseed | *Blepharoneuron tricholepis* | plant |
| pine satyr | *Paramacera allyni* | invertebrate |
| piñon ricegrass | *Piptochaetium fimbriatum* | plant |
| plains bristlegrass | *Setaria vulpiseta* | plant |
| plains harvest mouse | *Reithrodontomys montanus* | mammal |
| plains lovegrass | *Eragrostis intermedia Hitchc.* | plant |
| plains muhly | *Muhlenbergia cuspidata* | plant |
| plains spadefoot | *Spea bombifrons* | amphibian |
| pointleaf manzanita | *Arctostaphylos pungens Kunth* | plant |
| poison ivy | *Toxicodendron radicans* | plant |
| ponderosa pine | *Pinus ponderosa C. Lawson* | plant |
| Porsild's starwort | *Stellaria porsildii* | plants |
| prairie junegrass | *Koeleria macrantha* | plant |
| predaceous diving beetle | *Family Dytiscidae* | invertebrate |
| prickly pear | *Opuntia Mill.* | plant |
| pringle manzanita | *Arctostaphylos pringlei Parry* | plant |
| pringle needlegrass | *Piptochaetium pringlei* | plant |
| pronghorn | *Antilocapra americana* | mammal |
| psoralea | *Sphaeralcea psoraloides S.L. Welsh* | plant |
| purple grama | *Bouteloua radicosa* | plant |
| purple muhly | *Muhlenbergia rigida* | plant |
| purple-spike coralroot | *Hexalectris warnockii* | plants |
| purple threeawn | *Aristida purpurea Nutt.* | plant |
| ragweed | *Ambrosia L.* | plant |
| range ratany | *Krameria L* | plant |
| recurved corycactus | *Coryphantha recurvata* | plants |
| red-breasted nuthatch | *Sitta canadensis* | bird |
| red-faced warbler | *Cardellina rubrifrons* | bird |
| redosier dogwood | *Cornus sericea L.* | plant |
| red-spotted toad | *Anaxyrus puncatatus* | amphibian |
| ridge-nosed rattlesnake | *Crotalus willardi* | reptile |
| ringtail | *Bassariscus astutus* | mammal |
| rock rattlesnake | *Crotalus lepidus* | reptile |

| Plant or Animal Common Name | Plant or Animal Scientific Name | Taxa Group |
|---|---|---|
| rock wren | *Salpinctes obsoletus* | bird |
| Rocky Mountain maple | *Acer glabrum Torr.* | plant |
| rosary bean | *Rhynchosia senna* var. *texana* | plant |
| rose-throated becard | *Pachyramphus aglaiae* | bird |
| rosewood | *Vauquelinia californica* | plant |
| rough tridens | *Tridens muticus* var. *muticus* | plant |
| roundtail chub | *Gila robusta* | fish |
| round-tailed ground squirrel | *Spermophilus tereticaudus* | mammal |
| round-tailed horned lizard | *Phrynosoma modestum* | reptile |
| Rusby's hawkweed | *Hieracium rusbyi* | plants |
| rushes | *Juncus L.* | plant |
| sacaton | *Sporobolus airoides* | plant |
| saguaro | *Carnegiea gigantea* | plant |
| sand dropseed | *Sporobolus cryptandrus* | plant |
| sandpaper bush | *Mortonia scabrella* | plant |
| Santa Rita grama | *Bouteloua eludens* | plant |
| Santa Rita yellowshow | *Amoreuxia gonzalezii* | plants |
| Schott's yucca | *Yucca ×schottii Engelm.* | plant |
| screwleaf muhly | *Muhlenbergia straminea Hitchc.* | plant |
| scurfpea | *Psoralidium Rydb.* | plant |
| sedges | *Carex L.* | plant |
| shin-dagger | *Agave schottii* | plant |
| shortleaf tridens | *Erioneuron avenaceum* | plant |
| shrub live oak | *Quercus turbinella* | plant |
| shrubby buckwheat | *Eriogonum wrightii* | plant |
| shrubby deervetch | *Lotus rigidus* | plant |
| sida | *Rhynchosida Fryxell* | plant |
| sideoats grama | *Bouteloua curtipendula* | plant |
| silktassel | *Garrya Douglas ex Lindl.* | plant |
| silverleaf oak | *Quercus hypoleucoides* | plant |
| single-seed juniper | *Juniperus monosperma* | plant |
| skunkbush | *Rhus trilobata Nutt.* | plant |
| skunkbush sumac | *Rhus trilobata Nutt.* | plant |
| slender grama | *Bouteloua repens* | plant |
| slim tridens | *Tridens muticus* | plant |
| smooth baby-bonnets | *Coursetia glabella* | plants |
| snake cotton | *Froelichia* spp. | plant |
| sneezeweed | *Achillea ptarmica L.* | plant |
| soft Mexican-orange | *Choisya dumosa var. mollis* | plants |
| Sonora chub | *Gila ditaenia* | fish |

| Plant or Animal Common Name | Plant or Animal Scientific Name | Taxa Group |
|---|---|---|
| Sonoran coralsnake | *Micruroides euryxanthus* | reptile |
| Sonoran desert toad | *Ollotis alvaria* | amphibian |
| Sonoran mountain kingsnake | *Lampropeltis pyromelana* | reptile |
| Sonoran spotted whiptail | *Aspidoscelis sonorae* | reptile |
| sotol | *Dasylirion* spp. | plant |
| Southwest monkeyflower | *Mimulus dentilobus* | plants |
| southwestern stipa | *Achnatherum eminens* | plant |
| southwestern white pine | *Pinus strobiformis Engelm.* | plant |
| spidergrass | *Aristida ternipes Cav.* | plant |
| spikedace | *Meda fulgida* | fish |
| spike dropseed | *Sporobolus contractus* | plant |
| spike moss | *Selaginella arizonica* | plant |
| spike pappusgrass | *Enneapogon desvauxii* | plant |
| spreading ratany | *Krameria lanceolata* | plant |
| sprucetop grama | *Bouteloua chondrosioides* | plant |
| Stellar's jay | *Cyanocitta stelleri* | bird |
| Stephan's riffle beetle | *Heterelmis stephani* | invertebrate |
| striped plateau lizard | *Sceloporus virgatus* | reptile |
| striped skunk | *Mephitis mephitis* | mammal |
| sulphur-bellied flycatcher | *Myiodynastes luteiventris* | bird |
| talinum | *Talinum aurantiacum* | plant |
| talussnails | *genus Sonorella* | invertebrate |
| tanglehead | *Heteropogon contortus* | plant |
| Tarahumara Frog | *Lithobates tarahumarae* | amphibian |
| tarantulas | *Family Theraphosidae* | invertebrate |
| Texas bluestem | *Schizachyrium cirratum* | plant |
| thimbleberry | *Rubus parviflorus* | plant |
| threeawn grasses | *Aristida L.* | plant |
| tickclover | *Desmodium* | plant |
| tiger salamander | *Ambystoma mavortium* | amphibian |
| Toumey oak | *Quercus toumeyi* | plant |
| trailing fleabane | *Erigeron flagellaris* | plant |
| trailing four o'clock | *Allionia incarnata* | plant |
| triangle bursage | *Ambrosia deltoidea* | plant |
| triangleleaf bursage | *Ambrosia deltoidea* | plant |
| turbinella oak | *Quercus turbinella* | plant |
| turpentine bush | *Ericameria laricifolia* | plant |
| twinberry | *Myrcianthes fragrans* | plant |
| twin-spotted rattlesnake | *Crotalus pricei* | reptile |
| velvet ash | *Fraxinus velutina* | plant |

| Plant or Animal Common Name | Plant or Animal Scientific Name | Taxa Group |
|---|---|---|
| velvet-pod mimosa | *Mimosa dysocarpa* | plant |
| verbena | *Verbena L.* | plant |
| vetch | *Vicia* | plant |
| vine mesquite | *Panicum obtusum* | plant |
| Virginia creeper | *Parthenocissus quinquefolia* | plant |
| wandering gartersnake | *Thamnophis elegans* | reptile |
| warbling vireo | *Vireo gilvus* | bird |
| wavyleaf oak | *Quercus X pauciloba* | plant |
| wax currant | *Ribes cereum* | plant |
| Weidemeyer's Admiral | *Limenitis weidemeyerii* | invertebrate |
| western soapberry | *Sapindus saponaria* var. *drummondii* | plant |
| western yellow-billed cuckoo | *Coccyzus americanus occidentalis* | bird |
| whiskered screech-owl | *Megascops trichopsis* | bird |
| white fir | *Abies concolor* | plant |
| whiteball acacia | *Acacia angustissima* | plant |
| white-breasted nuthatch | *Sitta carolinensis* | bird |
| white-flowered cinquefoil | *Potentilla albiflora* | plants |
| white-nosed coati | *Nasua narica* | mammal |
| whitethorn acacia | *Acacia constricta* | plant |
| whortleberry | *Vaccinium myrtillus* | plant |
| wild grape | *Vitis vulpina* | plant |
| wild rose | *Rosa arkansana* | plant |
| wild turkey | *Meleagris gallopavo* | bird |
| wire lettuce | *Stephanomeria pauciflora* | plant |
| wishbone-bush | *Mirabilis bigelovii* var. *retrorsa* | plant |
| wolfberry | *Lycium L.* | plant |
| wolftail | *Lycurus phleoides* | plant |
| wood sorrel | *Oxalis L.* | plant |
| wooly bunchgrass | *Elionurus barbiculmis* | plant |
| Wright's beebrush | *Aloysia wrightii* | plant |
| xanthocephalum | *Xanthocephalum gymnospermoides* | plant |
| Yaqui catfish | *Ictalurus pricei* | fish |
| Yaqui chub | *Gila purpurea* | fish |
| Yarrow's spiny lizard | *Sceloporus jarrovii* | reptile |
| yellow leaf silktassel | *Garrya flavescens* | plant |
| yellow-nosed cotton rat | *Sigmodon onchrognathus* | mammal |
| yerba de pasmo | *Baccharis pteronioides* | plant |
| yerba mansa | *Anemopsis Californica* | plant |
| yewleaf willow | *Salix taxifolia* | plant |
| zebra-tailed lizard | *Callisaurus draconoides* | reptile |

# Appendix E. Other Sources of Information

## Vegetation Communities

### Federal Statutes

Organic Act of 1897 (16 U.S.C. 475, 551); Organic Administration Act of 1897 (16 U.S.C. 475, 551); Weeks Law of 1911, as amended (16 U.S.C. 515, 552); Knutson-Vandenberg Act of 1930 (16 U.S.C. at 576b); Anderson-Mansfield Reforestation and Revegetation Joint Resolution Act of 1949 (16 U.S.C. 581j and 581j(note)); Granger-Thye Act of 1950 (16 U.S.C. at 580g-h); Surfaces Resources Act of 1955 (30 U.S.C. 611-614); Sikes Act (Fish and Wildlife Conservation) of September 15, 1960 (16 U.S.C. at 670g); Multiple Use-Sustained Yield Act of 1960 (16 U.S.C. 528-531); Wilderness Act of 1964 (16 U.S.C. §§ 1131 et seq.); Wild and Scenic Rivers Act (82 Stat. 906, as amended, 16 U.S.C. 1271 (note), 1271-1287); National Environmental Policy Act (NEPA) of 1969 (16 U.S.C. 4321 et seq.); Endangered Species Act of 1973 (P.L. 93-205, 87 Stat. 884; 16 U.S.C. 1531-1544, as amended); Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974, as amended by National Forest Management Act (NFMA) of 1976 (16 U.S.C. 1600-1614, 472a); Clean Water Act of 1977 (33 U.S.C. 1251, 1254, 1323, 1324, 1329, 1342, 1344; 91 Stat. 1566); Clean Air Act, as amended 1977 and 1990 (42 U.S.C. 7401, 7418, 7470, 7472, 7474, 7475, 7491, 7506, 7602); North American Wetland Conservation Act of 1989 (16 U.S.C. 4401 (note), 4401-4413, 16 U.S.C. 669b (note)); Healthy Forests Restoration Act (HFRA) of 2003 (16 U.S.C. at 1611-6591)

### Code of Federal Regulations

35 CFR 4247 Protection and Enhancement of Environmental Quality; 37 CFR 2877 Use of Off-road Vehicles on the Public Lands; 42 CFR 26951 Floodplain Management; 42 CFR 26961 Protection of Wetlands; 64 CFR 6183 Invasive Species.

### Executive Orders

EO 11514 Protection and Enhancement of Environmental Quality; EO 11644 Use of off-road vehicles on the public lands; EO 11988 Floodplain Management; EO 11990 Protection of Wetlands; EO 13112 Invasive Species

### Forest Service Directives

FSM 5100-5190; FSM 2020, FSM 2070.

## Biophysical Features

### Federal Statutes

Federal Cave Resources Protection Act of 1988, 16 U.S.C. 4301-4309: Established requirements for the management and protection of caves and their resources on Federal lands, including allowing land managing agencies to withhold the location of caves from the public, and requiring permits for any removal or collecting activities in caves on Federal lands.

### Code of Federal Regulations

36 CFR 290: Parks, Forest and Public Property, Cave Resources Management.

### Forest Service Directives

FSM 2800 Minerals and Geology, Geologic Resources, Hazards and Services; FSM 2356 Cave Management.

### Other

Central Arizona Grotto 2013. Coronado National Forest Cave and Karst Management Guide https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd540162.pdf

## Natural Water Sources

### Federal Statutes

Federal Water Pollution Control Act of 1956 and Amendments of 1972 (Clean Water Act); Organic Administration Act, 1897 as amended; National Forest Management Act, 1976; Safe Drinking Water Act, 1977

Land and Water Conservation Fund Act of September 3, 1964: Authorizes the appropriation of funds for Federal assistance to states in planning, acquisition, and development of needed land and water areas and facilities and for the Federal acquisition and development of certain lands and other areas for the purposes of preserving, developing, and assuring accessibility to outdoor recreation resources.

### Executive Orders

EO 11990, 1977 Wetlands Management; EO 11998, 1977 Floodplain Management

### Forest Service Directives

FSM 2510-2520 Watershed and Air Management, Watershed Planning and Watershed Protection and Management; FSM 2530 Water Resource Management; FSM 2540 Water Uses and Development, Regional Supplement No. 2500-2001-1; FSM 2502-2503 Watershed and Air Management, Objectives and Policy; FSM 2541.03 Water Uses and Developments, Policy; FSM 2541.12 Instream and Standing Water Requirements; FSM 2521 Watershed Protection and Management, Watershed Condition Assessment; FSM 2502 & 2503 Watershed and Air Management, Objectives and Policy; FSM 2521.11(b) Watershed Condition Assessment, Priority Setting

FSH 2509.16 Water Resource Inventory Handbook; FSH 2509.22 Soil and Water Conservation Handbook, Region 3, Chapters 10 - 40, FSH 2509.23 Riparian Area Handbook; FSH 2509.13 Burned-Area Emergency Rehabilitation Handbook; FSM 2526, Watershed and Air Management, Riparian Area Management.

## Soil

### Federal Statutes

Multiple Use Sustained Yield Act of 1960; Bankhead-Jones Farm Tenant Act of 1937 as amended

### Forest Service Directives

FSM 2550 Watershed and Air Management, Chapter 50, Soil Management; FSH 2509.18; Soil Management Handbook; FSH 2509.22, Soil and Water Conservation Handbook.

## Air

### Federal Statutes

Clean Air Act of August 7, 1977, as amended (1977 and 1990) 42 U.S.C. §7401 et seq. (1970): Enacted to protect and enhance the quality of the Nation's air resources; to initiate and accelerate a national research and development program to achieve the prevention and control of air pollution; to provide technical and financial assistance to State and local governments in connection with the development and execution of their air pollution prevention and control programs; and, to encourage and assist the development and operation of regional air pollution prevention and control programs.

### Executive Orders

EO 11514, 1970 Protection and enhancement of environmental quality.

### Forest Service Directives

FSM 2580.2 - 2580.3 Watershed and Air Management, Chapter 80 Air Resource Management, Objectives and Policy.

### Other

Arizona Regional Haze Implementation Plan[49]; Arizona Revised Statute 49-501; Arizona Administrative Code Title 18 Chapter 2 Article 15 Forest and Range Management Burns.[50]

## Animals and Rare Plants

### Federal Statutes

Bankhead-Jones Farm Tenant Act of 1937; Multiple-Use Sustained-Yield Act of 1960; National Forest Management Act of 1976; Endangered Species Act of 1973; Migratory Bird Treaty Act of 1918; Sikes Act of 1960; 3150.2 State and Private Forestry, Rural Community Fire Protection Program, Objectives; Federal Noxious Weed Act of 1975.

Bald and Golden Eagle Protection Act of 1940, as amended: Prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. The act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect,

[49] http://www.azdeq.gov/function/forms/docs.html#sip
[50] http://www.azdeq.gov/environ/air/smoke/download/prules.pdf

molest or disturb." Disturbance includes impacts that result from human-induced alterations in the nesting area even when eagles are not present. Sections 22.26—28 allow take of bald and golden eagles or their nests where it is unavoidable and where it is compatible with the continued preservation of the eagle. Permits for take are issued based on certain criteria such as, but not limited to, certifications, reporting, and monitoring.

Endangered Species Act of 1973, as amended: Authorizes the determination and listing of species as endangered and threatened; prohibits unauthorized taking, possession, sale, and transport of endangered species; authorizes the assessment of civil and criminal penalties for violating the act or regulations; and, authorizes the payment of rewards to anyone furnishing information leading to arrest and conviction for any violation of the act or any regulation issued thereunder. Section 7 of the act requires Federal agencies to use their authorities to carry out programs for the conservation of endangered and threatened species and to insure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of listed species or modify their critical habitat.

Fish and Wildlife Conservation Act of September 15, 1960: Requires the Secretaries of the Interior and Agriculture, in cooperation with State agencies, to plan, develop, maintain, and coordinate programs for the conservation and rehabilitation of wildlife, fish, and game on public lands under their jurisdiction.

Wild Free-Roaming Horses and Burros Act of December 15, 1971, as amended by Federal Land Policy Management Act of 1976 and Public Rangelands Improvement Act of 1978: Protects wild free roaming horses and burros from capture, branding, harassment, or death; and states they are to be considered in the area where presently found an integral part of the natural system of the public lands.

### Executive Orders

EO 13186, Responsibility of Federal Agencies to Protect Migratory Birds.

### Code of Federal Regulations

36 CFR 241.2 Parks, Forests, and Public Property, Fish and Wildlife, Cooperation in Wildlife Management.

### Forest Service Directives

FSM 2402 Timber Management, Objectives; FSM 2470.2 - 2470.3 Timber Management, Chapter 70 Silvicultural Practices, Objectives and Policy; FSM 2670-2671Wildlife, Fish, and Sensitive Plant Habitat Management, Chapter 70, Threatened, Endangered, and Sensitive Plants and Animals, Cooperation; FSM 2671.45 C & F 2671 Wildlife, Fish, and Sensitive Plant Habitat Management, Interim Directives; FSM 3110.2 State and Private Forestry, Cooperative Forest Fire Prevention, Objectives.

### Other

1982 Rule Provisions, Sections 219.13-219.26; U.S. Fish and Wildlife Service Wind Turbine Guidelines Advisory Committee Recommendations to the Secretary, March 4, 2010; Avian Power Line Interaction Committee Guidelines; *Hedeoma diffusum* Management Plan (1984); Cimicifuga Arizonica Conservation Plan (1995).

## Invasive Species

### Federal Statutes

Federal Noxious Weed Act of 1974, as amended. Requires federal land management agencies to develop and establish a management program for control of undesirable plants that are classified under state or federal law as undesirable, noxious, harmful, injurious, or poisonous.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) of 1947; National Strategy and Implementation Plan for invasive Species Management, FS-805 (2004); U.S. Forest Service Invasive Species Program Web site. Provides the authority for the registration, distribution, sale, shipment receipt and use of pesticides.

### Executive Orders

EO 13112 on Invasive Species, December 5, 2016, establishes the National Invasive Species Council and directs that invasive species will be controlled on all federal lands.

### Forest Service Directives

FSM 2900, 2011, Invasive Species Management. Sets forth National Forest System policy, responsibilities, and direction for the prevention, detection, control, and restoration of effects from aquatic and terrestrial invasive species (including vertebrates, invertebrates, plants and pathogens).

### Other

National Strategy and Implementation Plan for Invasive Species Management, FS-805 (2004).

Forest Service National Strategic Framework for Invasive Species Management, FS-1017, 2013. Prioritizes and guides the prevention, detection, and control of invasive insects, pathogens, plants, wildlife, and fish that threaten our Nation’s terrestrial and aquatic ecosystems.

## Forest Products

### Federal Statutes

National Environmental Policy Act of 1969; National Forest Management Act of 1976.

### Code of Federal Regulations

36 CFR 223.5 through 36 CFR 223.10 Parks, Forests, and Public Property, Scope of Free-use Granted to Individuals, Cutting and Removal of Timber in Free-Use Areas, Permission for Free-Use of Timber Outside Free-Use Areas, Delegations of Authority to Approve Free Use by Individuals, Free-Use to Owners of Certain Mining Claims, Free-Use to Alaskan Settlers, Miners, Residents, and Prospectors; 36 CFR 223.2 Disposal of Timber for Administrative Use; 7 CFR 2.60 Agriculture, Chief, Forest Service; 36 CFR 223.12 Permission to Cut, Damage, or Destroy Trees without Advertisement; 36 CFR 800, National Historic Preservation Act; 36 CFR 223.261 Sale and Disposal of National Forest System Timber; Special Forest Products and Forest Botanical Products.

### Forest Service Directives

FSM 2000, Chapter 2020.12(5), Ecological Restoration and Resilience, Executive Orders; Chapter 2020.3(2) Policy; FSM 2400, Timber Management, Chapter 2462, Free Use of Timber; Chapter 2463, Administrative Use; FSM 2400, Chapter 2467 Sales of Special Forest Products, 36 CFR 223.1 Authority to Sell Timber; FSM 2400, Chapter 2431 Management of Timber Sale Program; FSH 2409.18, Timber Sale Preparation; Section; FSH 2409.18-2009-2, Section 82.5 Trees, Portions of Trees, or Forest Products Free of Charge for Indian Tribes for Non-Commercial Traditional and Cultural Purposes; FSH 2409.19 Renewable Resources Handbook; FSH 1909.15, Environmental Policy and Procedures Handbook; FSH 2409.19, Timber Sale Administration Handbook.

### Other

Forest Service National Resource Guide to American Indian and Alaska Native Relations, 12/05/1997; Tribal Consultation on Section 8105 of the Food, Conservation and Energy Act of 2008 (The Farm Bill); 16 U.S.C.2104 Note Stewardship End Result Contracting Projects.

## Fire Management

### Federal Statutes

National Environmental Policy Act of 1969; National Forest Management Act of 1976; Federal Land Assistance, Management, and Enhancement (FLAME) Act of 2009.

Healthy Forests Restoration Act of 2003 (H.R. 1904): Purposes are to reduce wildfire risk to communities and municipal water supplies through collaborative hazardous fuels reduction projects; to assess and reduce the risk of catastrophic fire or insect or disease infestation; to enhance efforts to protect watersheds and address threats to forest and rangeland health (including wildfire) across the landscape; to protect, restore, and enhance forest ecosystem components such as biological diversity, threatened/endangered species habitats, and enhanced productivity.

### Forest Service Directives

FSM 5110.2 Fire Management, Wildfire Prevention, Objective; FSM 5120 Fire Management, Preparedness; FSM 5130.2 Wildland Fire Suppression, Objective; Managing Impacts of Wildfires on Communities and the Environment, and Protecting People and Sustaining Resources in Fire Adapted Ecosystems – A Cohesive Strategy (FSM 5101, 5103, and 5108); FSM 5140.2 Fire Use, Objectives; FSM 5140.3 Fire Use, Policy; FSM 5171, Agreements with Federal Agencies; Interagency Prescribed Fire, Planning and Implementation Procedures Guide, Element 19-Smoke Management & Air Quality (USDA, USDOI) 2008; Guidance for Implementation of Federal Wildland Fire Management Policy, 2009; FSM 3110.2 Cooperative Forest Fire Prevention, Objective; FSM 3110.3 Policy (Smokey Bear); FSM 2324.2 Wilderness Management, Management of Fire; FSM 5100, Fire Management; FSH 5109.19 Chapter 50 Fire Management Analysis and Planning Handbook, Fire Management Planning.

### Other

The 1995/2001 Federal Wildland Fire Management Policy and Program Review; The Wildland and Prescribed Fire Management Policy and Implementation Procedures Reference Guide; The

Interagency Fire Management Plan template by the Fish and Wildlife Service, 2006[51]; National Cohesive Wildland Fire Management Strategy; USDOI, National Fire Plan, 2001. The Coconino National Forest Fire Management Plan, 2010; community wildfire protection plans (CWPP) for Flagstaff and surrounding communities, Blue Ridge and Mogollon Rim communities, Greater Williams Area, and the Tusayan community, and the Rim Country communities.

## Minerals

### Federal Statutes

Common Varieties of Mineral Materials Act of July 31, 1947: Authorizes the Secretaries of the Interior and Agriculture, under such rules and regulations as they may prescribe, to dispose of mineral materials (including but not limited to common varieties of sand, stone, gravel, pumice, pumicite, cinders, and clay) and vegetative materials (including but not limited to yucca, manzanita, mesquite, cactus, and timber or other forest products) on public lands of the United States, if the disposal of such materials is not otherwise expressly authorized by law, is not expressly prohibited by laws of the United States, and would not be detrimental to the public interest.

Mineral Leasing Act of February 25, 1920: Provides that the deposits of certain minerals on land owned by the United States shall be subject to lease to citizens of the United States, provided royalties on such deposits are paid to the United States.

Mining and Minerals Policy Act of December 31, 1970: States that it is the policy of the Federal Government to foster and encourage the development of economically sound and stable domestic mining, minerals, metal, and mineral reclamation industries; the orderly and economic development of domestic mineral resources, reserves, and reclamation of metals and minerals to help assure satisfaction of industrial, security, and environmental needs; mining, mineral, and metallurgical research to promote the wise and efficient use of our natural and reclaimable mineral resources; and the study and development of methods for the disposal, control, and reclamation of mineral waste products and the reclamation of mined land.

U.S. Mining Laws (Public Domain Lands) Act of May 10, 1872: Provides that all valuable mineral deposits in lands belonging to the United States, both surveyed and unsurveyed, are free and open to exploration and purchase, and the lands in which they are found to occupation and purchase by citizens of the United States and those who have declared their intention to become such, under regulations prescribed by law, and according to the local customs or rules of miners, so far as the same are applicable and not inconsistent with the laws of the United States. There are a number of acts that modify the mining laws as applied to local areas by prohibiting entry altogether or by limiting or restricting the use which may be made of the surface and the right, title, or interest which may pass through patent.

### Code of Federal Regulations

36 CFR 228 Subpart E, Oil and Gas Resources; 36 CFR 228 Subpart A, Locatable Minerals; 36 CFR 228 Subpart C, Disposal of Mineral Materials.

[51] http://www.fws.gov/fire/fmp/development/July08_FWS_template_guidance.doc

### Forest Service Directives

FSM 2800 Minerals and Geology; FSM 2320 Wilderness Management; FSM 2802 and 2803 Minerals and Geology, Objectives and Policy; FSM 2814 Mining Claims, Rights, and Obligations of the United States; FSM 2822.41 Mineral Licenses, Permits, and Leases Administer by the Department of the Interior, Forest Service Evaluation and Report; FSM 2850 Mineral Materials; Surface Occupancy Standards and Guidelines for Oil and Gas Exploration and Development (the Gold Book) published by BLM; FSM 2822.62, Actions by Forest Service; FSM 2814.01, Mining Claims, Rights of United States; FSM 2814.23 Prevent Violations of Laws and Regulations; FSM 2822.02 Mineral Leases, Permits, and Licenses, Objective; FSM 2822.04 Responsibility; FSM 2880.3 Geologic Resources, Hazards and Services, Policy.

## Energy Resources

### Federal Statutes

Energy Policy Act of 2005: Requires the Secretary of Agriculture to ensure timely action on oil and gas permits, improve collection and retrieval of oil and gas information, and improve inspection and enforcement of permit terms (Section 362).

Energy Security Act of June 30, 1980: Authorizes the Secretary of Agriculture to make available timber resources of the National Forest System, in accordance with appropriate timber appraisal and sale procedures, for use by biomass energy projects.

Food, Conservation & Energy Act of 2008 (2008 Farm Bill) Public Law 110-246

Title VIII – Forestry, Subtitle A, B, and C:

**Subtitle A:** Amendment to the Cooperative Forestry Assistance Act of 1978. Establishes national priorities for private forest conservation, a community forest and open space conservation program, and a Secretary level forest resources coordinating committee.

**Subtitle B:** Cultural and Heritage Cooperation Authority. Authorizes the Secretary of Agriculture to provide forest products to Indian Tribes for traditional and cultural purposes; to protect the confidentiality of certain information, including information that is culturally sensitive to Indian Tribes; to utilize National Forest System land for the reburial of human remains and cultural items, including human remains and cultural items repatriated under the Native American Graves Protection and Repatriation Act; prevent the unauthorized disclosure of information regarding human remains or cultural items reburied on National Forest System land; to ensure access to National Forest System land, to the maximum extent practicable, by Indians and Indian Tribes for traditional and cultural purposes; to increase the availability of Forest Service programs and resources to Indian Tribes in support of the policy of the United States to promote Tribal sovereignty and self-determination; and to strengthen support for the policy of the United States of protecting and preserving the traditional, cultural, and ceremonial rites and practices of Indian Tribes, in accordance with the American Indian Religious Freedom Act (42 U.S.C. 1996).

**Subtitle C:** Amendments to Other Forestry Related Laws. Amends the Lacey Act to include the illegal taking of plants, establishes an Emergency Forest Restoration Program, and renews authority and funding for the Healthy Forest Reserve Program.

## Motorized Transportation System

### Code of Federal Regulations

36 CFR 212 Travel Management; 36 CFR 261 Prohibitions.

### Forest Service Directives

FSM 5460 Right-of-Way Acquisition; FSM 7701.2 Travel Management; FSM 7702 Travel Management, Objectives; FSM 7703 Travel Management, Policy; FSM 7710 Travel Management, Travel Planning; FSM 7730 Road Operation and Maintenance.

FSH 2509.22 Soil and Water Conservation Handbook; FSH 7709.55 Travel Planning Handbook; FSH 7709.56 Road Preconstruction Handbook; FSH 7709.59 Road System Operations and Maintenance Handbook.

### Other

Forest Service Washington Office correspondence dated November 10, 2010, re: Travel Management, Implementation of 36 CFR, Subpart 212, Subpart A (36 CFR 212.5(b); Forest Service Washington Office correspondence re: Fiscal Year 2010 Final Program Direction.

## Recreation

### Dispersed Recreation

Code of Federal Regulations

36 CFR 212, Travel Management; 36 CFR 251, Land Uses; 36 CFR 261, Prohibitions; 36 CFR 294, Special Areas.

### Forest Service Directives

FSM 1802 and 1803 Senior, Youth and Volunteer Programs, Objectives and Policy; FSH 2309.18.4, Trails Management Handbook; FSM 2300, Recreation, Wilderness, and Related Resource Management.

## Developed Recreation

### Federal Statutes

National Trails System Act, 2009.

### Code of Federal Regulations

36 CFR 213 Administration of Lands under Title III of Bankhead-Jones Farm Tenant Act by the Forest Service; 36 CFR 261Prohibitions; EO 11988 Floodplain Management.

### Forest Service Directives

R3 Supplement to FSM 2300 Recreation, Wilderness, and Related Resource Management; FSM 2310 Planning and Data Management; FSM 2311 Resource Opportunities in Recreation Planning; FSM 2330.3 Publicly Managed Recreation Opportunities, Policy; FSM 2353.16 Trail, River and

Similar Recreation Opportunities; Cooperative Agreements and Rights-of-Way; FSM 2390 Interpretive Services; FSM 5340.2 Law Enforcement, Objectives; FSM 5420 Land Purchases and Donations; FSM 7151.02 Land Surveying, Objectives; FSM 7312.1 and 7312.2 Facility Planning, Plans, and Preliminary Project Analysis; FSH 7309.11 Chapter 40 Buildings and Related Facilities, Management; Forest Service Outdoor Recreation Accessibility Guidelines; FSM 7400 Public Health and Pollution Control Facilities.

FSH 7409.11, Sanitary Engineering and Public Health Handbook; Forest Service Outdoor Recreation Accessibility Guidelines, 5/22/2006; FSM 2303 Recreation, Wilderness and Related Resource Management, Policy; FSM 2334 Recreation, Wilderness, and Related Resource Management, Campgrounds and Picnic Grounds.

### Other

Recreation Facility Analysis Program of Work; 1986 Recreation Opportunity Spectrum Book; The Built Environment Image Guide (FS-710); Architectural Guidelines for Recreation Residences; Forest Service Outdoor Recreation Accessibility Guidelines; Forest Service Trail Accessibility Guidelines; USDA Forest Service Exhibit Accessibility Checklist; Accessibility Guidebook for Outfitter/Guides Operating on Public Lands (FS-757); Accessibility Guidebook for Ski Areas Operating on Public Lands (FS-703); Coronado National Forest Transition Plan; Cave Creek Recreation Concept Plan; Patagonia-Sonoita Scenic Road Corridor Management Plan; Swift Trail Parkway Corridor Management Plan; Sky Island Scenic Byway Corridor Management Plan; Sabino Canyon Recreation Concept Plan; Sabino Canyon Interpretive Plan; Management Guidelines for OHV Recreation by the National Off-Highway Vehicle Conservation Council; Arizona Statewide Comprehensive Outdoor Recreation Plan (SCORP); Arizona Trail Management Guide; Pusch Ridge Wilderness Management Plan

## Scenic Quality

### Federal Statutes

Wild and Scenic Rivers Act of October 2, 1968: Instituted a National Wild and Scenic Rivers System by designating the initial components of that system, and by prescribing the methods by which and standards according to which additional components may be added to the system from time to time.

### Code of Federal Regulations

36 CFR 213.3 Part B Administration of Lands under Title III of the Bankhead-Jones Farm Tenant Act by the Forest Service: Protection, occupancy, use, administration, and exercise of reservations

### Forest Service Directives

FSM 2380.13 Landscape Management, Scenic Trails and Byways; FSM 2380.6- 2380.62 Technical Publications and References, Current Publications, Superseded Reference; FSM 2380.14 Landscape Management, Wild and Scenic Rivers; FSM 2380.18 Landscape Management, Land Ownership Adjustments ; FSM 2380.3 Landscape Management, Policy; FSM 2380.31 Landscape Management, Resource Planning and Management; FSM 2380.43 Landscape Management, Responsibility, Forest Supervisor; FSM 2382.1 Landscape Management, Scenery Management, Scenery Management System.

Landscape Aesthetics Handbook (U.S. Forest Service Agriculture Handbook No. 701); FSH 1909.12 (13.13a).

### Other

Landscape Aesthetics, A Handbook for Scenery Management (FSH 701); The Built Environment Image Guide (FS-710); Architectural Guidelines for Recreation Residences; Patagonia-Sonoita Scenic Road Corridor Management Plan; Swift Trail Parkway Corridor Management Plan; Sky Island Scenic Byway Corridor Management Plan

## Special Uses

### Federal Statutes

Act of 1866 General Mining Law; Act of March 3, 1925 (43 Stat. 1133, as amended); The Act of March 4, 1915, as amended July 28, 1956, (16 U.S.C. 497); The Act of November 16, 1973, (30 U.S.C. 185), amending Section 28 of the 1920 Mineral Leasing Act; Alaska National Interest Lands Conservation Act, 1980; An Act to Repeal Timber-Culture Laws, 1891; Archaeological Resources Protection Act of 1979; Bankhead-Jones Farm Tenant Act of 1937, Section 31-33; Colorado Ditch Act of 1986 (FLPMA amendment; Energy Policy Act of 2005; Education Land Grant Act; Exchange for Schools Act (Sisk Act) of December 4, 1967 (81 Stat. 531, as amended; 16 U.S.C. 484a, 521c-521i); Federal Land Policy and Management Act of 1976; Forest Service Facilities Realignment Act of 2005 (119 Stat 559-563; 16 U.S.C. 580d, as amended); General Exchange Act of 1922; Granger-Thye Act of 1950, section 7; Highway Act of August 27, 1958, (23 U.S.C. 317), supplemented by the Act of October 15, 1966 (49 U.S.C. 1651); Land and Water Conservation Fund Act of September 3, 1964; Mineral Leasing Act of 1920, as amended on November 16, 1973, (30 U.S.C. 185(1)); National Forest Roads and Trails Act 1964; Oil and Gas Pipeline amendment to the Mineral Leasing Act, Section 28 authorizes oil and gas pipelines; Organic Act of 1897 provides for rules to regulate occupancy and use of the Forest Reserves; Occupancy Permits Act (March 4, 1915); Preservation of American Antiquities Act of June 8, 1906; Small Tracts Act of January 12, 1983 (96 Stat. 2535; 16 U.S.C. 521c-i); Telecommunications Act of 1996 (Public Law 104-104); Term Permit Act of March 4, 1915, amended July 28, 1956; National Forest Townsite Act of July 31, 1958 (72 Stat. 483; 7 U.S.C. 1012a; 16 U.S.C. 478a) as amended by Section 213 of the Federal Land Policy and Management Act of 1976 (90 Stat. 2760); Water Conveyance Act of 1986 amended FLMPA; Weeks Law of March 1, 1911(36 Stat. 961 as amended; 16 U.S.C. 516).

### Code of Federal Regulations

36 CFR 251 Subpart B Land Uses, Special Uses; 36 CFR 254, subpart A.

### Executive Orders

EO 11990 Wetlands; EO 11988 Floodplains.

### Forest Service Directives

FSM 2700 Special Uses Management; FSH 2709.11 Special Uses Handbook

### Other

Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines (FWS direction; these guidelines will be superseded by the guidelines developed by the U.S. Fish and Wildlife Service Wind Turbine Guidelines Advisory Committee, once they are finalized and adopted by the Secretary of the Interior); Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 2006, Avian Powerline Interaction Committee (APLIC) 2006; Edison Electric Institute, Washington D.C. Standard Guidance for Towers with Potential Impacts to Federally Listed Species and Migratory Birds (document prepared by the U.S. Fish and Wildlife Service).

## Cultural Resources

### Federal Statutes

Historic Sites Act of 1935 (16 U.S.C. 461): Establishes a policy to preserve for public use historic sites, buildings, and objects of national significance for the benefit of the people. Authorizes the National Park Service's National Historic Landmarks Program.

National Historic Preservation Act of 1966 as amended (NHPA) (16 U.S.C. 470): Sets forth the Federal Government's policy to preserve and protect historical and cultural resources. This act states that the historical and cultural foundations of the Nation should be preserved as a living part of the Nation's community life and development in order to give a sense of orientation to the American people. Directs all Federal agencies to take into account the effects of their undertakings (actions, financial support, and authorizations) on properties included in or eligible for the National Register. Establishes inventory, nomination, protection, and preservation responsibilities for federally owned historic properties. As amended extends the policy in the Historic Sites Act to State and local historical sites as well as those of national significance, expands the National Register of Historic Places, establishes the Advisory Council on Historic Preservation and the State Historic Preservation Officers, and requires agencies to designate Federal preservation officers. Establishes criteria for designating Tribal historic preservation officers to assume the functions of a state historic preservation officer on Tribal lands.

National Historic Preservation Act of December 12, 1980 as amended (1980 and 1992): Authorized the Federal Government to accelerate its historic preservation programs and activities; to give maximum encouragement to agencies and individuals undertaking preservation by private means; and to assist State and local governments and the National Trust for Historic Preservation in the United States to expand and accelerate their historic preservation programs and activities.

Antiquities Act of 1906 (16 U.S.C. 431-433): Prevents the appropriation, excavation, injury, or destruction of any historic or prehistoric ruin or monument, or any object of antiquity, situated on lands owned or controlled by the United States without permission. Provides for permits, for misdemeanor-level penalties for unauthorized use, and authorizes the President to declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon lands owned or controlled by the United States to be national monuments, and to reserve as a part thereof parcels of land needed for the proper care and management of the objects to be protected. The Archaeological Resources Protection Act has replaced the Antiquities Act as the authority for special use permits if the resource involved is 100-years old or greater.

Archaeological and Historic Preservation Act of 1974 (AHPA) (16 U.S.C. 469): Is also known as the Archaeological Recovery Act. AHPA amended and expanded the Reservoir Salvage Act of

1960 and was enacted to complement the Historic Sites Act of 1935 by providing for the preservation of significant scientific, historical, and archaeological data that might be lost or destroyed as the result of the construction of a federally authorized dam or other construction activity. AHPA also allows for any Federal agency responsible for a construction project to appropriate a portion of project funds for archaeological survey, recovery, analysis, and publication of results.

Archaeological Resources Protection Act of 1979 as amended (ARPA) (16 U.S.C. 470aa-mm et seq.): The act establishes permit requirements for removal or excavation of archaeological resources from Federal and Indian lands. Provides criminal and civil penalties for the unauthorized excavation, removal, damage, alteration, defacement, or the attempted unauthorized removal, damage, alteration, or defacement of any archaeological resource, more than 100 years of age, found on Federal or Indian lands. Prohibits the sale, purchase, exchange, transportation, receipt, or offering of any archaeological resource obtained from public lands or Indian lands. The act further directs Federal land managers to survey land under their control for archaeological resources and create public awareness programs concerning archaeological resources.

Historic Sites Act of 1935 (16 U.S.C. 461): Establishes a policy to preserve for public use historic sites, buildings, and objects of national significance for the benefit of the people. Authorizes the National Park Service's National Historic Landmarks Program.

### Code of Federal Regulations

36 CFR 800 Protection of historic Properties; 36 CFR 60.4 National Register of Historic Places, Criteria for Evaluation.

### Executive Orders

EO 13175 Consultation and Coordination with Indian Tribal Governments; EO 13007 Indian Sacred Sites; EO 13007 Indian Sacred Sites; EO 13287 Preserve America, (Partnering to Promote Heritage Tourism in Communities: Guidance for Federal Agencies, 2003); EO 11593 Protection and Enhancement of the Cultural Environment.

### Forest Service Directives

FSM 2360 Heritage Program Management; FSM 2360.7 Heritage Program Management, Program Funding Structure; FSM 2364.03 Protection and Stewardship, Policy; FSM 2364.02 Objectives, American Indian Religious Freedom Act, 1978; FSM 2360.7 Heritage Program Management, Program Funding Structure; FSM 2364.03 Protection and Stewardship, Policy; FSM 2364.02 Objectives.

### Other

Region 3, First Amended Programmatic Agreement Regarding Historic Property protection and Responsibilities (and associated appendices), December 2003; U.S. Forest Service Tribal Relations Strategic Plan.

# Paleontological Resources

## Federal Statutes

Organic Act of 1897 (16 USC 551); Bankhead-Jones Tenant Act of 1937 (7 USC 1101); 1906 Antiquities Act, FS Special Uses Manual 2701.1-2; National Environmental Policy Act of 1969: 42 U.S.C. 4321, sec. 101(b).; Forest and Rangeland Renewable Resources Planning Act of 1974, as amended; 1979 Archeological Resources Protection Act; 1988 Federal Cave Resources Protection Act; PL 101-510 (H.R. 4739, sec. 2825); Paleontological Resources Preservation Act of 2009 (PL 111-011).

Antiquities Act of 1906 (16 U.S.C. 431-433): Prevents the appropriation, excavation, injury, or destruction of any historic or prehistoric ruin or monument, or any object of antiquity, situated on lands owned or controlled by the United States without permission. Provides for permits, for misdemeanor-level penalties for unauthorized use, and authorizes the President to declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon lands owned or controlled by the United States to be national monuments, and to reserve as a part thereof parcels of land needed for the proper care and management of the objects to be protected. The Archaeological Resources Protection Act has replaced the Antiquities Act as the authority for special use permits if the resource involved is 100-years old or greater.

Archaeological and Historic Preservation Act of 1974 (AHPA) (16 U.S.C. 469): Is also known as the Archaeological Recovery Act. AHPA amended and expanded the Reservoir Salvage Act of 1960 and was enacted to complement the Historic Sites Act of 1935 by providing for the preservation of significant scientific, historical, and archaeological data that might be lost or destroyed as the result of the construction of a federally authorized dam or other construction activity. AHPA also allows for any Federal agency responsible for a construction project to appropriate a portion of project funds for archaeological survey, recovery, analysis, and publication of results.

Archaeological Resources Protection Act of 1979 as amended (ARPA) (16 U.S.C. 470aa-mm et seq.): The act establishes permit requirements for removal or excavation of archaeological resources from Federal and Indian lands. Provides criminal and civil penalties for the unauthorized excavation, removal, damage, alteration, defacement, or the attempted unauthorized removal, damage, alteration, or defacement of any archaeological resource, more than 100 years of age, found on Federal or Indian lands. Prohibits the sale, purchase, exchange, transportation, receipt, or offering of any archaeological resource obtained from public lands or Indian lands. The act further directs Federal land managers to survey land under their control for archaeological resources and create public awareness programs concerning archaeological resources.

## Code of Federal Regulations

7 CFR 2.60: Delegation of Authority from Secretary of Agriculture to Chief, Forest Service to regulate use and occupancy of National Forest System Lands; and to issue appropriate regulations under 36 CFR 261, Prohibitions; 43 CFR Part 3;7 CFR 3100.41(a); 36 CFR 251; 36 CFR 251.53(a) and (f) permits for vertebrate fossil collection for scientific and education purposes only; 36 CFR 261.2, 261.9(i), 261.70(a)(5): Prohibitions Section, Orders, special closures, and ability for regions to issue regulations for protection of paleontological resources; 36 CFR 228.62(e) Free-use permit may be required for limited collection of petrified wood for personal use by amateur collectors and scientists. Material cannot be bartered or sold; 36 CFR

296.5(b)(2).; 36 CFR 290; 36 CFR 292.41, second definition of paleontological resources; 43 CFR 3505.11.

### Forest Service Directives

FSM 2880 Geologic Resources, Hazards and Services; FS Manual 2701.1-2 Paleontological resources management under 1906 Antiquities Act; FSM 2860 Recreational collecting of mineral and fossil material under acquired lands.

## Tribal Relations

### Federal Statutes

American Indian Religious Freedom Act (AIRFA) as amended (42 U.S.C. 1996): Protects and preserves for American Indians their inherent right of freedom to believe, express, and exercise the traditional religions of the American Indian, Eskimo, Aleut, and Native Hawaiians, including but not limited to access to sites, use, and possession of sacred objects and the freedom to worship through ceremonial and traditional rites.

Tribal Forest Protection Act of 2004 (Public Law 108-278): Authorizes the Secretary of Agriculture and the Secretary of the Interior to enter into an agreement or contract with Indian Tribes meeting certain criteria to carry out projects to protect Indian forest land.

### Congressional Acts

National Historic Preservation Act Sections 106 and 110; The Native American Grave Protection and Repatriation Act; American Indian Religious Freedom Act, 1978; Archaeological Resources Protection Act, 1979; Food Conservation and Energy Act of 2008 (The Farm Bill).

## Range Management

### Federal Statutes

Bankhead Jones Farm Tenant Act of 1937

Forest and Rangeland Renewable Resources Planning Act of August 17, 1974: Directs the Secretary of Agriculture to prepare a renewable resource assessment every 10 years; to transmit a recommended renewable resources program to the President every 5 years; to develop, maintain, and, as appropriate, revise land and resource management plans for units of the National Forest System; and to ensure that the development and administration of the resources of the National Forest System are in full accord with the concepts of multiple use and sustained yield.

Public Rangelands Improvement Act of October 25, 1978: Establishes and reaffirms the national policy and commitment to inventory and identify current public rangeland conditions and trends; manage, maintain and improve the condition of public rangelands so that they become as productive as feasible for all rangeland values in accordance with management objectives and the land use planning process; charge a fee for public grazing use which is equitable; continue the policy of protecting wild free roaming horses and burros from capture, branding, harassment, or death, while at the same time facilitating the removal and disposal of excess wild free roaming horses and burros which pose a threat to themselves, their habitat, and to other rangeland values.

### Code of Federal Regulations

36 CFR 213 Administration of Lands under Title III of the Bankhead-Jones Farm Tenant Act by the Forest Service.

### Forest Service Directives

FSM 2202 Range Management, Objectives; FSM 2230.2 and 2230.3 Grazing and Livestock Use Permit System, Objective and Policy; FSM 2231.02 Grazing and Livestock Use Permit System, Requirements for Permits with Term Status; FSM 2240.2 and 2240.3 Range Improvements, Objective and Policy; FSM 2242.02 Structural Range Improvements, Objective; FSM 2242.03 Policy; FSM 2243.02 Nonstructural Range Improvements, Objective; FSM 2243.03 Policy; FSM 2250.2 and 2250.3 Range Cooperation, Objective and Policy; FSM 2270.3 Information Management and Reports, Policy; FSM 2237.03 Range Management, Policy; FSM 2541.03 Water Uses and Development, Policies; FSM 2253.4 Range Cooperation, Cooperation with Others; FSM Information Management and Reports, Policy.

FSH 2209.13, Chapter 12.31 Grazing Permit Administration Handbook, Permits with Term Status, Upper Limits; FSH 2209.13 Chapter 90 Rangeland Management Decisionmaking.

### Other

Interagency Technical Reference (USDA, USDOI), Utilization Studies and Residual Measurements,1996; Technical Reference 4400-5 Rangeland Inventory & Monitoring, Supplemental Studies, 1992; Technical Reference 4400-7 (BLM) Rangeland Monitoring Analysis, Interpretation, and Evaluation, 1985; Technical Reference 4400-8 (BLM) Rangeland Monitoring, Statistical Considerations, 1992.

## Land Ownership Adjustments and Boundary Management

### Federal Statutes

Cooperative Forestry Assistance Act of July 1, 1978: Authorizes the Secretary of Agriculture to assist in the establishment of a coordinated and cooperative Federal, state, and local forest stewardship program for the management of non-Federal forest lands and forest lands in foreign countries.

Federal Land Policy and Management Act of October 21, 1976: Requires that public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archaeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use. Also states that the United States shall receive fair market value of the use of the public lands and their resources unless otherwise provided for by law.

### Code of Federal Regulations

36 CFR 254 Land Ownership Adjustments; 43 CFR 2300 Land Withdrawals.

### Forest Service Directives

FSM 5400 Land Ownership; FSM 2354.51(a) Fee Title Acquisition on Designated Rivers; FSM 2354.6 Nondesignated Rivers; FSM 2760 Withdrawals; FSH 5409.12 Appraisal Handbook; FSH 5409.13 Land Acquisition Handbook; FSH 5409.17 Rights-of-Way Acquisition Handbook; FSH 5509.11Title Claims, Sales, and Grants Handbook.

## Public Access

### Federal Statutes

Federal Land Policy and Management Act of October 21, 1976.

Public Law 91-646: The Uniform Relocation Assistance and Real Property Acquisition Policies Act of January 2, 1971.

### Code of Federal Regulation

36 CFR 212 – Travel Management

### Forest Service Directives

FSM 5460 – Right-of-Way Acquisition; FSH 5409.17 – Right-of-Way Acquisition

## Recommended Wilderness Areas and Wilderness Study Areas

### Federal Statutes

Wilderness Act of September 3, 1964: Established a National Wilderness Preservation System to be composed of federally owned areas designated by Congress as “wilderness areas” and administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness. Provides for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness. States that no Federal lands shall be designated as “wilderness areas” except as provided for in the act or by a subsequent act.

## Wilderness Areas

### Federal Statutes

Wilderness Act of 1964, Public Law 88-577

### Forest Service Directives

FSH 1909.12 Chapter 70 Wilderness Evaluation, Subsection 71.1 Criteria for Including Improvements; FSH 1909.12 Chapter 70 Wilderness Evaluation, Subsection 72.1 Capability; FSH 1909.12, FSH 1909.12 Chapter 70 Wilderness Evaluation, Subsection 72.3 factors to consider.

FSM 2320 – Wilderness; FSM 1923 – Wilderness Evaluation

### Other

Monitoring Selected Conditions Related to Wilderness Character: A National Framework.

R3 Wilderness Evaluation Guidance

Monitoring Selected Conditions Related to Wilderness Character: A National Framework, USDA Forest Service, Rocky Mountain Research Station, General Technical Report RMRS-GTR-151.

## Wild and Scenic Rivers

### Federal Statutes

Wild and Scenic Rivers Act of 1968 (PL 90-542)

### Forest Service Directives

FSM 2354.02 Trail, River, and Similar Recreation Opportunities, Objective; FSM 2354.03 Trail, River, and Similar Recreation Opportunities, Policy; FSM 2354.04 Trail, River, and Similar Recreation Opportunities, Responsibility; FSM 2354.21 Recreation, Wilderness, and Related Resource Management, Management of Study Rivers; FSM 2354.42 (a-p) Wild and Scenic River Resource Protection and Management; FSM 1924 – Wild and Scenic River Evaluation.

FSH 1909.12 Chapter 80 – Wild and Scenic River Evaluation

### Other

IWSRCC, The WSR Study Process, December 1999.

USDA/USDI Guidelines for Eligibility, Classification, and Management of River Areas dated September 7, 1982.

Resource Information Report for Potential Wild, Scenic, Recreational River Designation, National Forests of Arizona, September 1993.

Other wild and scenic river comprehensive river management plans.

## National Trails and Scenic Byways

### Federal Statutes

National Historic Preservation Act Sections 106 and 110; National Trails System Act of 1968; Transportation Equity Act for the 21st Century of 1998, or most recent reauthorizing legislation.

### Code of Federal Regulations

36 CFR 800 Parks, Forests, and Public Property, Advisory Council on Historic Preservation; 36 CFR 60.4 National Register of Historic Places, Criteria for Evaluation.

### Forest Service Directives

FSM 2300 Recreation, Wilderness, and Related Resource Management; FSM 2353.11 Recreation, Wilderness, and Related Resource Management, Chapter 50 Trail, River, and Similar Recreation Opportunities, Relationship Between National Recreation, National Scenic, and

National Historic Trails and NFS Trails; FSM 2380.13 Landscape Management, Scenic Trails and Byways.

### Other

National Forest Road and Trails Act (FRTA) of October 13, 1964

Granger-Thye Act of April 24, 1958

## Other Special Areas Research Natural Areas (RNA), and Botanical and Geological Areas

### Forest Service Directives

FSM 4063.02 Research Natural Areas, Objectives & FSM 4063.03 Research Natural Areas, Policy; FSM 4000 Research and Development, Chapter 4060, Research Facilities and Areas, Policy; FSM 2880 Geologic Resources, Hazards and Services, Chapter Section 2882.8 Special Interest Areas and Research Natural Areas; FSM 2300 Recreation, Wilderness and related Resource Management, Chapter 2370 Special Recreation Designations.

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